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Electrical Review

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THE PARIS EXHIBITION.

In this issue of the ELECTRICAL REVIEW a considerable amount of space is devoted to an account of the opening, the present status, and the general arrangement of the Paris Exposition, together with a somewhat detailed description of the electrical exhibit.

The exposition is still so far from completion that it is hardly just to criticise the somewhat meagre display of electrical apparatus mentioned by our correspondent. It is interesting to note that the United States exhibits seem to be of the first order of excellence and that this country is represented by a very large number of exhibitors. This does not necessarily mean that these exhibitors represent the great bulk of our industries for the reason that industry is so much specialized in the United States that the number of manufacturing concerns is legion. On the continent of Europe the great houses in the electrical manufacturing business make all manner of electrical goods from push buttons to power generators, and a few exhibitors practically cover the field of electrical manufacture in their respective countries. For this reason, while American participation in the exposition is numerically large, it is not likely that nearly so complete a showing of American electrical machinery will be made as was exhibited at Chicago in 1893.

It is said that of questions of taste there can be no dispute. At the same time it seems strange that Paris, for so long a time the arbiter of fashion and a city supposedly the home of all that is beautiful and graceful in design and architecture, should have erected so extraordinary a group of buildings as those devoted to the exposition. Their architecture seems to express gayety and restlessness in its bewildering detail, but nowhere does it show the stately dignity that marked the White City on Lake Michigan, in 1893.

It is to be hoped that the exposition will be a complete success. It will doubtless do much for the promotion of international commerce and from the congresses that will assemble during its term much of good may be expected. Perhaps, however, the value of the exposition as an insurance of peace is its highest claim to recognition.

A NATIONAL STANDARDIZING BUREAU.

There is now pending before Congress a bill for the establishment of a National Standardizing Bureau. It was transmitted to the House of Representatives by the Secretary of the Treasury and consists of provisions converting the present Office of Standard Weights and Measures into a standardizing bureau somewhat on the plan and scope of the German Reichsanstalt. To quote the bill:

"The functions of the bureau shall consist in the custody of the standards; the comparison of the standards used in scientific investigations, engineering, manufacturing, commerce, and educational institutions with the standards adopted or recognized by the Government; the construction when necessary of standards, their multiples, and subdivisions; the testing and calibration of standard measuring apparatus; the solution of problems which arise in connection with standards; the determination of physical constants, and the properties of materials when such data are of great importance to scientific or manufacturing interests and are not to be obtained of sufficient accuracy elsewhere."

As to the importance and value of such an institution there can be but one opinion. It is probable that the great recent commercial advance of Germany is due as much as anything else to the part that has been played in its manufactures by the Reichsanstalt. It is curious that the United States should be behind England, France, Germany, Austria and Russia in a matter of such vital importance to its immense manufacturing interests. It is urgently to be hoped that the bill will pass, and it seems the duty of every manufacturer to see that his representative does not allow this exceedingly beneficial legislation to perish in a committee room.

ELECTRICAL APPLIANCES ON SHIPBOARD.

A modern vessel, whether it be a merchant tramp, a high-speed passenger packet or a ship of war, is a remarkable complex of machinery. Where, in old days, a swarm of sailormen lay about the decks ready to pull here or haul there or jump into the rigging and lay aloft to handle sail, the donkey engine and the electric winch stand ready to do the work better and more quickly. The puff of steam and the purring of cogs are more frequent sounds than the swearing of the mates, and the rhythmic tramp of "all hands" around the capstan is almost forgotten.

When the engine was set afloat to provide motive power for ships it did not take long to find out that it could be made also an auxiliary to do much of the hard work of hoisting, of handling and of moving and hauling, and thus reduce the personnel of the ship. So, as steamships have grown and multiplied, the auxiliary uses of steam aboard them have also developed until on the average steamship of to-day the work of steering, of hoisting cargo, of handling most of the weights about ship, of ventilation, of pumping and many other kinds of labor that once the boatswain's whistle summoned the crew to do are accomplished by steam engines or by electric motors.

The sailorman is a conservative creature. It was not until the applications of electric power ashore were highly developed that this method of providing the auxiliary forces of a ship came to be recognized at its true value. To-day there is a strong tendency toward the installation of electric auxiliaries on all kinds of vessels and these have proven their right to the place by accomplishing the work set for them to do in the most satisfactory way. We have nowadays electric hoists, electric blowers, electric winches, electric steering gear, electric pumps and electric fans. Their use should be far more general than it is even to-day and the reasons are almost too simple to require much explanation.

The steam engine must have a steam pipe connecting it with the boiler. The modern ship is divided into more or less air-tight and water-tight compartments, and the presence of a steam pipe in one of these, especially in hot weather or if the ship trades to tropical ports, is exceedingly disagreeable and may be highly detrimental and dangerous. But worse than these drawbacks, at least from the owner's point of view, is the fact that small steam auxiliaries are tremendously wasteful of power and that steam piping is also a constant source of expense and trouble from condensation, leakage and general unfitness as a method of power transmission. The electric wire, when properly installed, is safe, economical and satisfactory. It does not heat the cargo spaces or compartments, there is no danger of its bursting and scalding to death with a cloud of hot steam those nearby, and the electric motor that it feeds is the most satisfactory power machine that has ever been invented for practically all purposes. The navy, which is in many respects far in advance of the merchant marine in the completeness and perfection of its engineering, is already beginning to discard the steam auxiliary in favor of the electrical method of power distribution and application for the minor purposes of the ship.

A ship afloat at sea is a unit of highly concentrated property. No means can be too perfect to insure the safety of the ship, its contents and its passengers. Not infrequently this safety depends upon the perfection and certainty of operation of the ship's auxiliaries. The perfection of operative certainty and safety in this regard has been found with electrical apparatus. The deduction to be drawn from these facts is too simple to require statement.

ELECTRICITY IN MEDICINE.

A good story was related the other day in a New York newspaper. It appears that some years ago, in discussing the value of patents, a patent lawyer and one of his clients made a bet concerning what could be done with an absolutely worthless invention properly advertised and exploited. Articles of agreement covering the bet were made and one of the parties to it proceeded to file an application for a patent on a method of curing all diseases by means of a small brass cylinder to which a string was attached. The cylinder was to be soaked in cold water and the end of the string attached to the person of the patient. The other man objected to going ahead with so ridiculous an enterprise, but was restrained by the conditions of the bet. A moderate amount of capital being invested in advertising the alleged cure-all, it suddenly became popular, had a tremendous success, is still in use, made thousands upon thousands of dollars for its promoters and finally led to a lawsuit between the two friends to determine the distribution of the gains. This is a case in point exactly. Indeed, this particular instrument made so much money for its promoters that the patents upon it have actually been infringed.

There is nothing about which people are so credulous as remedies for sickness. There is, therefore, nothing out of which the smart "fakir" can make so easy a profit as out of this particular brand of credulity. If only he can inject some element of mystery into his devices then he is sure of his victims. Toward electricity, naturally, this type of charlatan has turned and about two-thirds of the alleged marvelous cure-alls that we see advertised in the newspapers are claimed to be electrical in their operation.

Electricity in some of its forms and under certain processes of application has unquestionably been of therapeutic value. Electro-therapeutics to-day is a subject for investigation at the hands of numerous earnest, scientific and truthful men who are working with a genuine desire for the furtherance of knowledge and the relief of suffering. But the sins that have been committed in its name are too many to catalogue even if one could patiently undertake to tell the story of deceit and robbery, of deception and imposition upon the afflicted that is involved in it. It is fair to assume that any electrical remedy or any alleged electrical treatment largely advertised is what is called, commonly, a "fake." The genuine electro-therapeutist is bound by the traditions and ethics of the medical profession and does not use such methods to attract publicity.

THE PARIS EXPOSITION OF 1900

A FULL ACCOUNT OF THE OPENING CEREMONIES AND A SKETCH OF THE MAIN FEATURES OF THE ELECTRICAL AND MECHANICAL SECTIONS.

THE OPENING CEREMONIES—ADDRESSES OF M. MILLERAND AND PRESIDENT LOUBET—BRILLIANT OPENING SCENES—PLAN AND ARRANGEMENT OF THE EXPOSITION GROUNDS AND BUILDINGS—FOREIGN BUILDINGS—THE UNITED STATES BUILDING—THE ELECTRICAL BUILDING—AMERICAN, FRENCH, GERMAN, SWISS, ITALIAN AND OTHER ELECTRICAL AND MECHANICAL EXHIBITS.

BY C. L. DURAND, RESIDENT PARIS CORRESPONDENT OF THE "ELECTRICAL REVIEW."

The formal inauguration of the Paris Exposition has been one of the most brilliant fetes that Paris has seen for a long time. An extraordinary amount of energy was displayed in getting the buildings ready for the occasion, and scaffoldings were taken down, grass, trees, and gravel walks were laid out as if by magic. The weather was perfect for the great fete, and all through the city the principal buildings were decorated in honor of the occasion. The formal ceremony had been fixed for Saturday, the 14th of April, and the grounds were to be opened to the public on Easter Sunday. The ceremony proper was held in the great Salles des Fetes which had been newly finished, after which the Presidential party made an official tour of the grounds.

President Loubet left the Elyseé shortly before two o'clock in the afternoon; the cortege, which was escorted by a squadron of cuirassiers, was made up of four landaus. The first of these contained the president, accompanied by the president of the ministerial council and by General Baillaud; in the others were the ministers and the various civil and military members of the cabinet. The cortege, surrounded by an immense crowd, followed the route of the Avenue de Marigny, across the Avenue des Champs Elyseés, and crossed the Seine by the Pont des Invalides, reaching the Salle des Fetes by the Avenue de la Motte Picquet. This immense circular hall, which has just been finished, presents an imposing appearance, with its vast dome of stained glass, upheld by a series of arches. The hall has been very handsomely decorated with panels and statuary, carving, Gobelin tapestries, etc. Before the entry of the president, the immense throng of official visitors had already taken their places on the rows of seats which had been arranged for them. This was composed of the members of the Senate and Chamber of Deputies, the Municipal Council, members of the Legion d'Honneur, as well as the diplomatic corps, military attaches and all the principal dignitaries. In the first row of the ladies' tribune was Madame Loubet, accompanied by the wives of the ministers, etc. The president arrived at two o'clock, in full dress, wearing the grand cordon of the Legion d'Honneur. He was received by M. Millerand, Minister of Commerce, accompanied by other officials, including M. Picard, the commissioner general of the exposition. An immense orchestra played the Marseillaise while M. Loubet arrived at the Presidential tribune and took his place between the presidents of the senate and of the chamber. M. Millerand pronounced the preliminary discourse. He said, in part:

FAÇADE OF THE ELECTRICITY BUILDING AND ILLUMINATED FOUNTAIN, PARIS EXPOSITION, AS THEY APPEARED ON THE OPENING DAY.

"The universe is associated with France in this gigantic enterprise. The government of the Republic fulfills a very pleasant duty of hospitality and of recognition in expressing its thanks to the sovereigns, to the chiefs of state and to the friendly peoples who have shown so much cordiality in the reception of our invitation. To them the visitor to the exposition owes the present miracle, that he can in a few minutes make a tour of the world. Types of all the architectures of the earth grouped side by side upon the two banks of the Seine in a pleasant and harmonious disorder captivate his imagination and satisfy his eyes and by a natural association of ideas this picturesque decoration gives rise to this reflection that, far as these peoples appear from one another in education, in costume and in prejudices, all of them, sons of various races, citizens of diverse nationalities, belong to the same family and their duty, as their interest, is continually to work to increase the common patrimony of science and of beauty. What progress has been realized, what transformations have been worked in the short space of three generations, a glance at this centennial exposition suffices to reveal. . . .

"Words fail to describe the greatness and extent of this economical revolution. We have seen the forces of nature conquered and disciplined. Steam and electricity reduced to the condition of docile service have transformed the conditions of existence. The machine has become the ruler of the world. Installed as master in our workshops the organism of iron and steel is constantly driving out and replacing by a slow and continuous invasion the workers of flesh and bone.

"Science multiplies with an admirable prodigality the means that she puts at the disposition of man to dominate exterior forces or to guarantee himself against their hostility. She renders him a more signal service in deliver ing to him the secret of the material and moral greatness of society—which is comprised in the word solidarity.

After the applause which followed, the president delivered the following address:

"In inviting the governments and the peoples to make this a synthesis of human labor the French Republic has not had the sole thought of instituting a concourse of visible marvels and of renewing upon the banks of the Seine her ancient renown for elegant and courteous hospitality. Her ambition is higher; it passes infinitely beyond the splendors of ephemeral festivities. . . . .

"France has desired to bring a brilliant contribution to the advancement of concord among the nations. . . . .

"Gentlemen, this harmonious work of peace and progress, however ephemeral its type, will not have been vain. The pacific encounter here of the nations of the world can not remain sterile. I am convinced that, thanks to the persevering affirmation of certain generous thoughts which the finishing century has evolved, the twentieth century will see a little more fraternity and less misery of all sorts, and that soon, perhaps, we will have reached a stage of finality in the slow evolution of labor toward happiness and of man toward humanity. It is under these auspices and with this hope that I declare the exposition of 1900 opened."

The address of the president lasted about ten minutes, and was received with great applause. The official ceremony finished about three o'clock, and the assembly left the Salle des Fêtes amid the music of the orchestra and chorus. The president then passed across the length of the hall and entered the reception room, where he received the various officials. The official promenade of the exposition grounds now remained to be made. The cortege passed into the Electrical Palace and made a tour of the second floor, where the exhibits are now being installed. As that of the Austrian section and the American pavilion are the farthest advanced, the party passed through them. At the American section a salute was given with the American flag. Upon descending by the side of the electrical fountain into the grounds of the Champ-de-Mars, the long façades of the palaces on either side appeared, with the fountain forming the background. The latter is now almost finished and gives a beautiful and imposing effect. The president stopped here for a few moments and the cortege then passed along the central avenue of the gardens, accompanied by a regiment of infantry. At various points the salute was given by the lowering of flags. After passing under the Eiffel tower, the cortege crossed the Seine by the Pont de Iena, where three boats had been provided to take the party along the Seine to the Champs Elyseés. The first contained the presidential party, the diplomatic corps and the functionaries of the exposition. It was newly ornamented and decorated with flags, the rear platform being covered with red draperies for the president's seat and party. M. Picard took a post next the president to indicate the various sections passed along on the way. At about four o'clock the boat started preceded and followed by two others containing the representatives of the press and the senators and deputies. The procession of boats passed slowly along between the line of palaces and pavilions on either side; from the windows of these the party was saluted by the crowds of visitors stationed there. After passing the Pont de l'Alma, the long series of national pavilions was reached, beginning with that of Mexico, which gave the salute by playing the Marseillaise; each of the pavilions saluted in a characteristic manner, and this was one of the novel parts of the programme. Germany, Norway, Belgium and Great Britain were passed; the palaces of Turkey and Hungary were especially noted for their brilliant exterior decorations, carpets and garlands being seen in profusion. Upon passing the United States pavilion, the presidential party was saluted by lowering the two large flags upon the poles at either side, while between them, under the portico, were held out two French flags. The new Alexandre III Bridge was now reached, where the landing was made on the left bank and the party mounted to the bridge, where the Marseillaise was played by the Russian military band. The president advanced over the bridge, preceded by several ranks of officers, towards the two main palaces of the Champ-de-Mars. The ground between the Grand and Petit Palaces had been set out with grass-plots and trees, fountains, and gravel walks. The party then reached the entrance on the Avenue des Champs Elyseés, where the ceremony finished. An escort of cuirassiers was waiting here to take the president back to the Elyseé, and he passed through the immense crowds amid enthusiastic cheers.

The number of privileged visitors to the grounds on the inauguration day was not less than 120,000, a reasonably large figure, but not large enough to satisfy the multitude of those who wished to attend. After the inauguration the visitors made a tour of the grounds and examined the new constructions whose façades had so recently been cleared of scaffolding, surrounded by grass and trees which seemed to have sprung up by magic. In fact, the work was finished at the last moment. On the morning of the inauguration day the workmen were putting the last touches of paint and gilding on the Alexandre III Bridge and mounting the bronze candelabra. The Salle des Fêtes presented the appearance a few days before, of a mass of beams and scaffolding, and this was torn down at lightning speed by a special corps, who also laid out the gardens in the Champ-de-Mars, and strewed the gravel walks. It has been a matter of general surprise that everything was put into shape in such a short time. In the interior of the various palaces much remains to be done in the way of installing the exhibits, but the façades are practically finished. The panorama seen in passing along the Seine from the Champ-de-Mars to the Pont de la Concorde is the most attractive and picturesque part of the exposition, but the most imposing and substantial portion is that represented by the Grand and Petit Palais and the new bridge. A view from the left bank of the Seine toward the Grand Palais is shown in one of the illustrations. From the bridge, in the other direction, continues the Esplanade des Invalides, bordered on either side by a series of handsome façades in staff, richly decorated. On the two principal façades near the river are a series of frescoes in brilliant colors.

As the exposition is for the most part within the city limits, a sufficient space was not available to lay it out so as to give it the harmonious appearance and proportions of the Chicago Exposition; the arrangement of space makes it necessary to divide it into two sections, these being connected by a series of buildings along the banks of the Seine. The two main buildings of the exposition are, however, to be permanent, and are built of light stone, having a handsome and imposing appearance. They are placed one on each side of the main avenue of the exposition, called the Avenue Nicolas II, forming the commencement of the Champs Elyseés section, which crosses the Seine and ends at the ancient Hoted des Invalides. The larger of the two buildings is called the Grand Palais. It covers an area of 50,000 square yards. The principal façade is formed of a main entrance or peristyle, upheld by six columns, arranged in three pairs, thus forming three entrances. On either side is a long colonnade of 15 columns surmounted by an ornamental balustrade. At intervals along the colonnade is a series of allegorical groups representing the different arts, and back of the columns is a very handsome frieze running along the whole length, this being formed of mosaics of many-colored porcelains. It has a very rich appearance. The rear façade has also a frieze of enameled brick, designed by prominent artists. The principal part of the palace is occupied by a vast hall with glass roof, which after the exposition will be used for various annual exhibitions. At present it is to contain a collection of paintings and sculptures of all nations. The main hall is united to a second and parallel hall in the rear by a cross-gallery. Both halls are provided with large galleries in the second story, which are reached by handsome staircases. Directly opposite, on the main avenue, is the Petit Palais, or small palace. This palace is of trapezoidal form, being built around a central court; it covers an area of 9,000 square yards. The façade is formed by 30 columns, with a large, arched doorway in the centre. In general style, the architecture of this building is somewhat simpler than that of the Grand Palais; it is built of the same material, a light colored stone, and has a solid and handsome appearance. Behind the colonnade is a succession of high windows, above which runs a frieze of carved stone. The building is surmounted by a dome and at either end is a smaller dome-like structure. The interior court is of semi-circular form, and is surrounded by a fine colonnade built of polished granite columns, giving a very rich effect. This palace contains the retrospective art exhibition.

The main avenue crosses the river by the new bridge, named after the father of the present Czar. Its corner-stone was laid in 1896, at the time of the Czar's visit to Paris. It crosses the Seine by an arch of 330 feet, built up of cast-steel segments, and is surmounted at each end by two large and handsome pylons, whose general style of construction harmonizes with that of the two palaces. Upon each of the pylons is is an allegorical group of gilded bronze; the bridge is to have a bronze balustrade, with a series of ornamental lamp-posts. For the lighting of the bridge, 508 incandescent lamps will be necessary. Upon reaching the other side of the river the avenue continues between a series of buildings which border it on either side for a considerable distance. At the end of the bridge it passes over the line of the Orleans underground electric road, which runs along the bank of the Seine; here a part of the pavement is formed of glass tiling to give light to the extensive underground station below, the roof being upheld by iron cross-beams supported upon heavy, cast-iron pillars. The avenue at this point is bordered by a fine garden. The surrounding buildings are of staff, varying in architectural design. After a short distance the avenue narrows and proceeds between a long succession of buildings, ending at the Invalides. The buildings at this section contain the national manufactures, furniture, glass, ceramics, etc.

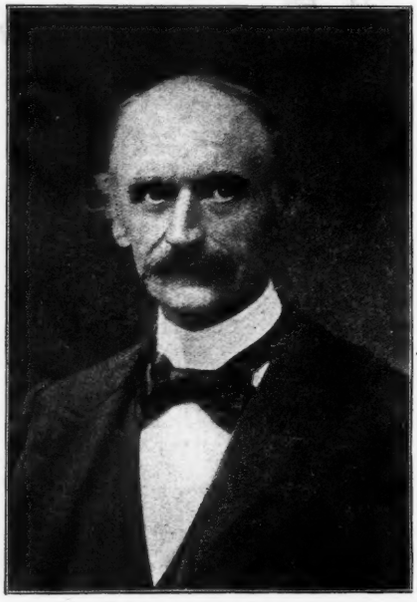
Not far from the end of the Alexandre III Bridge commences the series of foreign buildings, these being built upon a platform supported by iron construction and running along the bank of the Seine. Below the platform the electric road passes. The Italian building comes first, then Turkey, then the United States, Austria, Bosina, Hungary, Great Britain, etc., forming a long succession of buildings. The United States building presents an imposing appearance, being an architectural monument of solid and harmonious character. It is composed of a main quadrangular portion surmounted by a high dome of considerable dimensions and ornamental effect. At the top of the dome is seen the American eagle above the inscription, "United States of America." The United States building is is the highest of the series. On the river side a portico has been erected, taking somewhat the form of a triumphal arch, ornamented with Corinthian columns. The top of the arch is surmounted by a four-horse chariot, representing the Goddess of Liberty borne by the car of progress. Behind the arch and giving access to the interior is a doorway which opens at the back of a large niche decorated with handsome frescoes by American artists. In front, under

1.—View of the National Pavilions from the Alexandre III Bridge.
2.—The Alexandre III Bridge and Large Palace.
3.—Looking Across the Seine toward the Small Palace.
4.—The Small Palace.

Some of the Buildings of the Paris Exposition, from Photographs Made on the Opening Day.

the central arch, is to be placed an equestrian statue of George Washington. The centre of the building contains a large hall, under the dome; this is richly ornamented and is decorated with paintings representing scenes of American history. The hall is surrounded by balconies corresponding to each story, and is bordered to the right and left by a number of rooms, which, on the ground floor, will be used as reception rooms. Those of the other floors will be occupied as reception rooms for the different states, and for other purposes. The building has been designed and constructed in all its details by Americans, and home materials have been used throughout. It will have a brilliant effect at night, the building having a series of incandescent lamps which outline the silhouette as well as the main architectural lines. The top of the building as measured from the quay is about 160 feet; the dome measures more than 60 feet in diameter, and the chariot placed above the portico is at a height of 75 feet. These measurements give an idea of the size and the importance of the building.

Besides the long series of foreign buildings, the Seine is lined with various structures which form a connection between the two sections of the exposition. Among the most important of these may be mentioned, in order, that of the City of Paris; the Horticultural Building, with its two immense greenhouses on either side, and he Aquarium; the Palais des Congrés, where will be held the electrical and scientific congresses; the building devoted to Hygiene; that of the Army and Marine; a representation of Paris during the Middle Ages; a great collection of buildings of quaint architecture; the Navigation and Commerce; Forestry and Chase, etc. This line of buildings terminates at the Champ-de-Mars, which is a vast tract, 3,000 by 1,500 feet; this space was occupied by the exposition of 1889, of which but two structures remain in the Champ-de-Mars—the Eiffel Tower, near the river, and the Galerie des Machines, at the extreme rear of the grounds. This building, which somewhat resembles the Machinery Hall, at Chicago, is now subdivided; a circular Palais des Fetes has been constructed, in the centre, of amphitheatre form. It is here that the formal inauguration took place. The rest of the building is devoted to Agriculture and Aliments. The United States have an extensive pavilion in this section. The central garden of the Champ-de-Mars is surrounded by a series of buildings, whose façades form a uniform line around the three sides, the third side being completed by the Electrical Palace, whose façade is, in part, formed of the Electrical Fountain. The Electrical Palace has on either side a large dynamo hall; back of each of these is a corresponding boiler room. The Electrical Palace, being much higher than the surrounding buildings, dominates this part of the grounds and forms the central feature of the Champ-de-Mars. The building is of iron and glass construction, having a length of 400 feet and a total height of 220 feet. The apex of the building is surmounted by a cartouche bearing the date 1900, and above this is an allegorical figure representing the Goddess Electricity upon a car drawn by hippogriffs. The roof takes the form of a series of arcs joined to one another and upheld by pylons; this series descends at the sides, giving the palace an elliptical form which produces a graceful effect. Along the roof, in the front of the building, runs an ornamental crest of metal work; this is handsomely carved and will have a many-colored and gilded decoration. The façade is built of glass and ornamental metal work and has nine large windows with colored glass and ornamented with ceramics. The palace will be brilliantly lighted up by 5,000 incandescent lamps of different colors, eight powerful projectors, besides arc lamps with reflectors; the



MR. ALFRED PICARD, DIRECTOR GENERAL OF THE PARIS EXPOSITION.

whole is arranged to give an especially brilliant effect at night. The Electric Fountain is placed in front of and forms a part of the palace; it is composed of a great hemispherical niche, about 95 feet wide and 35 deep. From the top falls a sheet of water 35 feet wide into a series of basins below, which descend to join the principal basin on a level with the ground and extending far out in front of the fountain. The niche is surrounded by an ornamental arch, supported upon pylons at each side; the fountain will be richly ornamented with statuary and allegorical groups; one of the principal of these is placed at the beginning of the main basin and represents Humanity led in advance of Progress. The main fall gives 1,200 litres per second, and the water is utilized to supply the boilers and for condensation; an extensive series of piping has been arranged for this purpose. Around the exterior will be disposed a number of jets which fall into the main basin. Under the basin has been made a large excavation for the conduits and also to accommodate the arc light projectors for the fountain. The arrangement for illuminating the fountain has been well planned, and there is no doubt that this part of the display will be especially interesting. The palace and fountain will form a brilliant ensemble, with the 5,000 lamps of the former and the 1,000 of the latter. The central niche and fall will be lighted up by powerful projectors of varying colors.

On either side of the fountain is a series of arches, somewhat similar to those of the adjoining buildings, and below is a gallery by which the interior of the Electrical Palace is reached. This is built in two stories, the lower floor being designed for heavy machines, engines and dynamos, etc.; and the upper floor for various exhibits. Adjoining the palace at each end, and forming with it a continuous building, are the two main dynamo halls, containing the large machines which supply light and power to the exposition. Each of these vast halls is built of iron and glass, being 375 feet long and 90 feet wide, surmounted by an arched roof, to which slopes down the roof of the Electrical Palace on each side. The dynamo rooms are surrounded on the sides and ends by a series of galleries intended for a part of the exhibits, these being continuous with the second floor of the palace. From the floor two wide staircases on each end lead down to the dynamo rooms. One of these has been allotted to foreign exhibitors, the other being reserved for French machines. Behind each of the dynamo rooms is an extensive boiler room which has about the same length. Each of these is a light iron structure, open at the sides and ends. The boilers are arranged in two rows, and face outwardly, leaving a central passageway in which a railroad track has been laid. In this way the coal may be brought to the furnaces directly from the railroad. The fronts of the boilers are aligned and a space of 20 feet left in front for passageway. The boiler rooms are also divided into French and foreign sections, corresponding to the dynamo rooms. The arrangements for firing are well laid out, and a considerable sum has been expended in making this construction as complete as possible. Under each of the two rows of boilers is an arched masonry conduit to conduct the smoke from the furnaces to the chimney at the outer end. The conduits increase in section as they approach the chimney; they vary from seven and a half feet wide by eight feet high to six by seven and a half feet. The two conduits come together at the outer end of the building, and pass into the base of the chimney. These chimneys, of which there is one for each boiler room, are of monumental construction, having no less than 250 feet in height and an inside diameter of 14 feet. They are built in the cylindrical portion of red brick, but the bases and tops are formed of many-colored bricks and ceramics. For the various steam and water pipings, a series of underground conduits has been constructed; these pass throughout the grounds in longitudinal and transverse directions, and are provided with

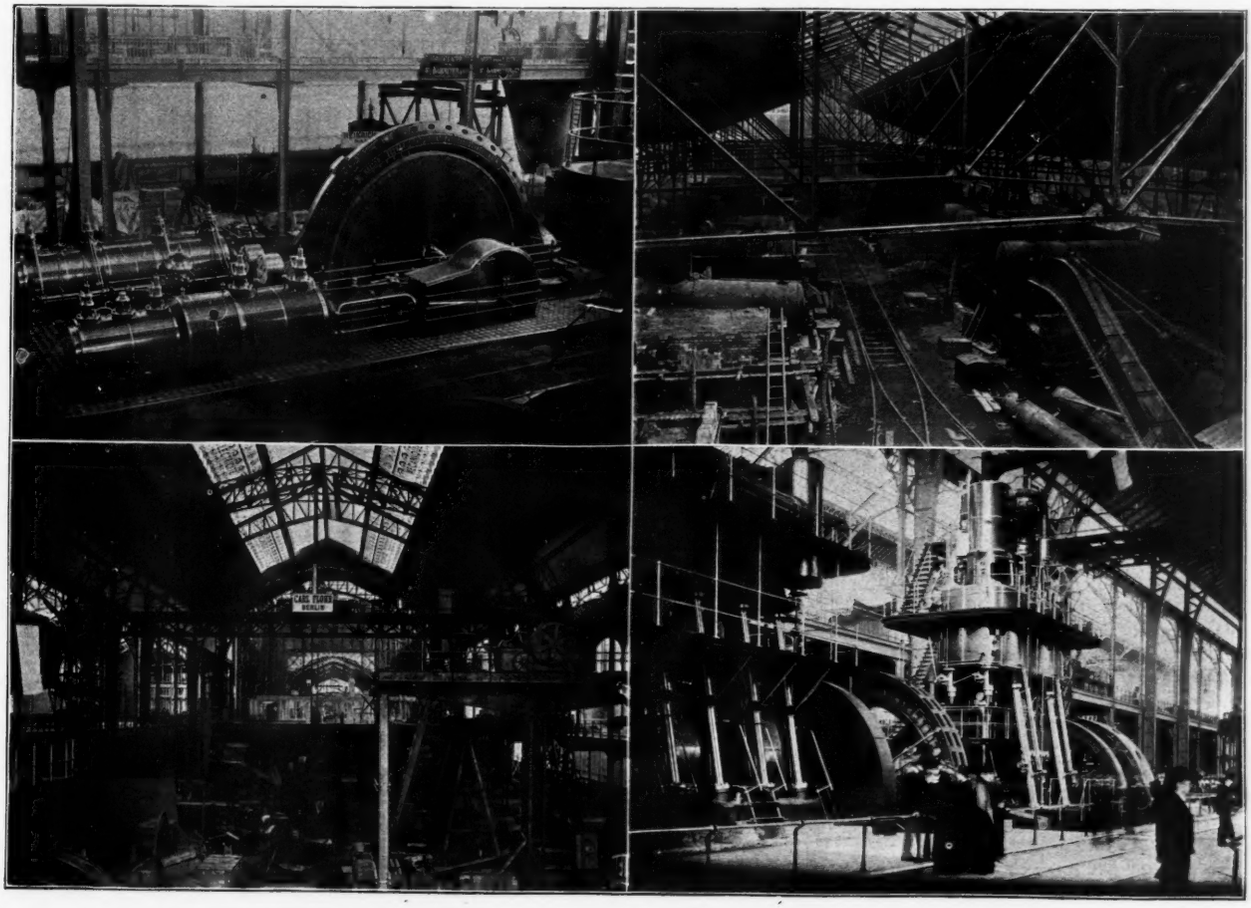
man-holes for the valves and connections. They contain the pipes supplying the boilers and condensers from the reservoir which feeds the fountain and the basin below, as well as the city water pipes, gas pipes, etc.

In the main dynamo rooms have been constructed a series of massive foundations on a level with the floor, to accommodate the great dynamos and engines which are to be installed here. Most of these are direct-connected units, single-phase or three-phase alternators, with armatures built upon the flywheels. The foundations have been laid out on each side of a central passageway, along which runs a railroad track, the cars thus bringing the pieces of machines directly into the building. To unload the cars and put the machines in place a powerful crane of 25 tons has been provided for each building. The crane in the foreign section consists of an immense arch-like construction, following the profile of the building, and rolling upon a track placed on either side next the wall. The carriage rolls upon a horizontal beam of trellis-work, thus passing above from one side of the building to the other. In the French section the crane is of the tower pattern, having also a capacity of 25 tons. It rolls upon a track in the centre of the building, considerably wider than the railroad track, and the cars thus pass beneath it. The tower carries on top a circle upon which the horizontal beam revolves around a central pivot; the carriage, traveling upon this cross-beam, can thus cover any point in the building.

Among the large alternators now being installed in the foreign section may be mentioned those of Siemens & Halske, of Berlin; the Helios Company, of Cologne; Lahmeyer; Schuckert & Company, of Nurnberg; Oerlikon and Thury, of Switzerland; Ganz & Company, of Budapest, and many other European makers. All the machines are direct-connected alternators, with vertical or horizontal engines. In the French section will be represented most of the leading firms, such as Schneider & Company, of Creusot; Farcot; Cail & Company; Postel-Vinay; the Fives-Lille Company, and others. On the second floor of the Electrical Palace and the galleries above the dynamo rooms are now being installed the various electrical exhibits; in the central part a number of handsome pavilions have been erected. Among these, the most noteworthy is that of the United States, which occupies one end of the building; it will be richly ornamented, containing reception rooms and other spaces devoted to exhibits and collections of apparatus, etc.

The long lines of buildings which border the sides of the Champ-de-Mars, cover a large extent of ground and have two floors, thus accommodating a vast number of exhibits. The interior of each line forms a continuous whole, but the façades are varied in style, although a succession of arcades runs through the entire length. Next to the French dynamo room commences the section devoted to mechanics, steam engines, machine tools, etc. Adjoining this is the section of textile fabrics and everything relating to the spinning and weaving industries; the farthest end is devoted to the metal industries, mining, etc. On the other side of the Champ-de-Mars the succession of buildings is divided into four sections; chemical industries, paper manufactures, leather, etc.; the civil engineering section comes next, including, besides engineering works, vehicles, railroads, tramways, navigation, etc.; adjoining is the educational section, and lastly that devoted to letters, sciences and arts, including typography, photography, books, instruments of precision, etc.

The Eiffel Tower has been left unchanged, except that it has been provided with hydraulic elevators operated by electric motors. In the space surrounding it are placed a number of smaller buildings, among which may be mentioned those of the Automobile Club of France; Postal



1.—Large Engine and Dynamo in German Section.
2.—View in the Boiler Room, French Section.
3.—In the Electrical Building, Foreign Section.
4.—Siemens & Halske and Schuckert Exhibits.

Some Views in the Electrical Section of the Paris Exposition.

and Telegraph Service; the Luminous Palace, in which a profusion of arc and incandescent lamps will be used; the Optical Building, containing the most powerful telescope yet constructed, besides many other attractions. Across the river from the Champ-de-Mars is to be found an interesting group of colonial exhibits. The French colonies are represented by Algeria, Madagascar, Senegal, etc.; the British colonies are represented, besides Japan, Siberia and many other nations. This section is terminated at the Palais de Trocadéro, one of the buildings remaining from the former exposition. This contains a number of colonial exhibits, among which the United States holds an important place.

The different parts of the exposition are connected by an elevated moving sidewalk and also by an electric railway, elevated for the most part, and following about the same route. The latter is mounted upon an elevated construction supported by iron arches, sometimes passing at the level of the ground or below the level. The cars are of the open type and carry two trucks of four wheels each, with motors of the Westinghouse system. For this a generating station has been erected near the exposition. An annex has also been laid out at the Parc de Vincennes, bordering the fortifications, which is arranged to accommodate a part of the groups including railroads and tramways, for which space enough was not found in the main grounds. Here are also the sections devoted to automobiles, bicycles and other vehicles, as well as agricultural machines. The group relating to sports and physical exercise has a large tract allotted to it. For the automobiles, a special track has been constructed, in which will take place the principal events of this year, these being held under the direction of the Automobile Club of France. The events include different automobile races and tests, and here one will have a good opportunity to compare the different types of electromobiles, which will be largely represented, both of French and foreign makers.

The greater part of the electrical exhibits, including the large machines which furnish light and power for the exposition, are contained in the Electrical Palace and the two dynamo rooms on either side, with their corresponding boiler-rooms. In the rear of the Electrical Palace is the hexagonal Salon d'Honneur, which is richly decorated in the interior, this being devoted to the retrospective exposition, including historic apparatus and documents. The lower floor of the Electrical Palace and dynamo-rooms is continuous, the former having a second floor which extends across. The electrical and mechanical sections have been grouped together to a greater or less extent, and while most of the ground floor is devoted to the large engines and dynamos necessary for the light and power, a number of other exhibits, such as boilers, condensers, air-compressors and machine-tools, occupy a part of the space. It will be noticed that on either side of the main dynamo halls a considerable space has been annexed, this being within the other buildings which commence here and extend along each side of the Champ-de-Mars.

The current supply for the different purposes of the exposition, for the lighting of the buildings and avenues, bridges, etc., as well as for the electric fountain and for the motors to be used in the different exhibits, is furnished by 38 direct-connected groups, the engines in all cases being coupled directly to the dynamos. The machines are about equally divided between continuous and alternating current, the latter being single-phase or three-phase. The total capacity of the groups in the French and foreign sections is 20,240 kilowatts, and that of the engines, 36,040 horse-power. A part of these machines are installed in the main dynamo rooms and the remainder in the two annexed portions and on the ground floor of the Electrical Palace. In one of the illustrations is shown a view taken from the gallery at the extreme end of the foreign dynamo-room, giving a general view of this section, in the rear is the second floor of the Electrical Palace, and farther on the French dynamo room. The great electric crane installed by a German firm, Carl Flohr, of Berlin, attracts attention on account of its size and construction; the crane takes the general shape of the building, its upright, constructed of wrought-iron trellis-work, being joined by an arch of similar design and following the line of the roof. The horizontal beam upon which the carriage rolls extends across, joining the uprights and forming a solid structure. Half-way up the left-hand side is mounted the platform which contains the switchboard, rheostats and controlling apparatus. This great crane has a capacity of 25 tons, and lifts the weight to a height of 12½ metres. The traveling carriage is about 14 metres from the ground, the total height of the crane, measured from the top of the arch, is 20 metres. To provide for the movement along the building, two rails of the usual railroad type have been laid side by side; these are connected below the flange by a series of cross-pieces, with which the pinion of the crane engages, thus moving it horizontally. The pinion is operated from a motor placed in the upper part of the crane. The foot of the crane is spread out fan-wise, to form a wide base, resting upon two rolling carriages, placed end to end; these have four wheels placed in a single line. The crane as a whole moves at the rate of 0.5 metre per second, using for the purpose a motor of 25 horse-power. The traveling carriage has two motors, the first of which gives 36 horse-power, and lifts the load at a speed of 0.04 metre per second; the second motor, of eight horse-power, propels the carriage at 0.3 metre per second. For the motors, direct-current at 220 volts is used, this being supplied by a temporary gas-engine installation. To give an idea of the amount of iron entering into its construction, it may be noted that the weight of the iron beams is estimated at 70 tons, and that of the mechanical parts, motors, etc., at 28 tons. In the main dynamo rooms and annexes, the machines are grouped according to nationality; the German section occupies a large space at one end of the main room, and has the most important collection of machines in the section, being represented by three large compound or triple-expansion engines and one horizontal engine, each with their respective dynamos. Especially noteworthy on account of its size is the upright engine shown on p. 441; this has been constructed by the Borsig firm, of Berlin. It is direct-coupled to a Siemens & Halske alternator of large size. The engine gives 2,230 horse-power, being one of the largest shown at the exposition. It has two platforms with connecting staircases to render all parts accessible. Its height is considerably above that of the second gallery. The shaft carries a flywheel next the engine, and upon a second exterior flywheel are mounted the field coils of the alternator, these being 80 in number. The armature is formed of an external ring of laminated iron, carrying a series of slots upon the inner periphery, in which a copper box winding is used, the bars being joined on the outside by bending. This machine has a capacity of 340 amperes at 2,200 volts; it is of the tri-phase type.

Adjoining this group is another direct-coupled set, the alternator being furnished by Schuckert & Company, of Nurnberg. It is of similar construction to the former, carrying a series of field poles upon the flywheel, these being surrounded by an exterior circle of laminated iron, with heavy cable winding in a series of slots around the periphery. It gives 100 amperes at 5,000 volts, being of the tri-phase type. The engine is also one of the largest at the exposition, being rated at 2,000 horse-power. It is of the upright type and triple expansion. The engine carries on the other side a 14-pole direct-current machine whose armature is wound upon the shaft; the capacity of this generator is 1,600 amperes at 250 volts, or 400 kilowatts. Opposite the latter group is a similar triple-expansion upright engine, driving a Lahmeyer alternator of 5,000 volts at 95 amperes, this being of the tri-phase type, and working at 50 cycles per second, like most of the machines at the exposition. The engine carries on the other side a six-pole, direct-current machine giving 1,400 amperes at 250 volts. The large alternator of the Helios Electric Company, of Cologne, is of quite a different type from the three first mentioned; the electrical design, however, is somewhat on the same order. The field cores, of which there are 84, are mounted around the rim of a large and heavy flywheel, supported by 12 double arms. The armature is wound in slots in the outer circle of laminated iron. It has a capacity of 1,060 kilowatts, giving 480 amperes at 2,200 volts. The engine is furnished by the Vereinigte Maschinenfabrik, of Augsburg, giving 1,900 horse-power. The total capacity of the engines of the German section amounts to 7,530 horse-power, and that of the dynamos, 3,500 kilowatts, and it will be seen that this section furnishes a good proportion of the total output.

Belgium furnishes three direct-connected groups, these being three-phase alternators working at 42-50 cycles per second. The first of these is made by Kolben & Company, being an 84-pole machine with internal field poles with heavy projections, and external slot winding. On the outer end of the shaft is mounted a six-pole exciter. The engine is of the horizontal type, built by the Carels firm, and is rated at 1,000 horsepower. The second alternator is furnished by the Electric and Hydraulic Company, of Charleroi, is of somewhat similar construction, giving 170 amperes at 2,200 volts, or 375 kilowatts. It is driven by a Bollinckx horizontal compound engine of 1,100 horse-power. The third group consists of a 350-kilowatt alternator, made by the Pieper Company, with a horizontal engine built by Van der Kerchove, of Ghent. The Belgian section furnishes a total capacity of 1,250 kilowatts for the dynamos and 3,100 horse-power for the engines.

The English exhibit includes three groups, besides steam apparatus and accessories. Siemens Brothers are erecting a large continuous-current machine of 1,340 kilowatts, giving 2,680 amperes at 500 volts. The engine, of 2,400 horsepower, is of the Willans & Robinson make. A second group consists of a Mather & Platt dynamo of 280 kilowatts, driven by a Galloway engine of 500 horse-power, and a third of a Robey direct-connected set of the same capacity. The total capacity of the English machines is 1,900 kilowatts and that of the engines 3,400 horse-power.

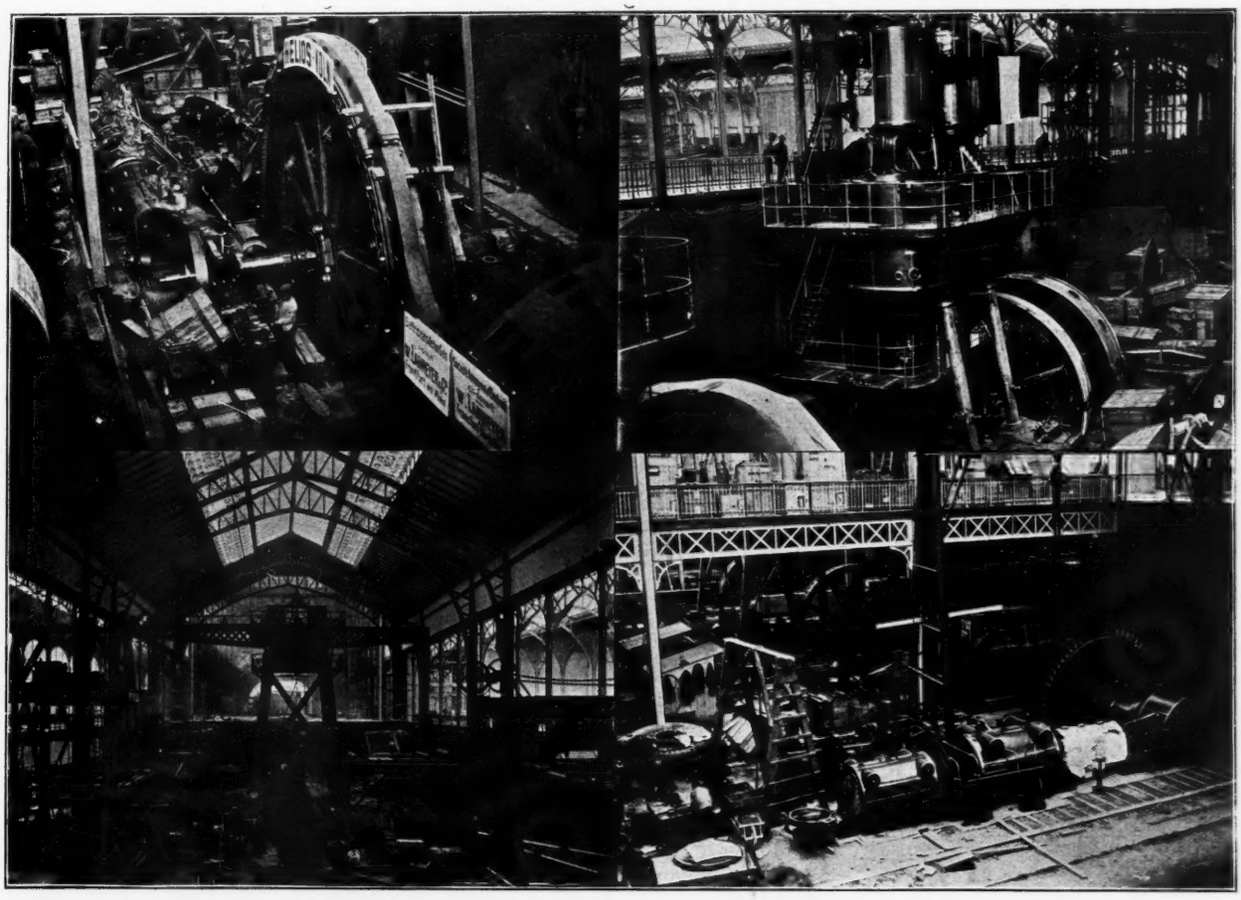
The Italian machines are on the ground floor of the Electrical Palace, and consist of two groups; the first of these is a Schuckert direct-current machine of 675 kilowatts at 500 volts, with an engine of the Franco-Tosi make, of 1,200 horsepower. To another engine of the same make, of 600 horse-power, is connected a Bacini machine of 350 kilowatts, also direct current.

The Austro-Hungarian section occupies a considerable space on the ground floor of the Electrical Palace, and three large direct-connected groups are placed here.

The Siemens & Halske Company, of Vienna, have a generator of 900 kilowatts driven by a Ringhoffer engine of 1,600 horse-power. Two large alternators are installed by Ganz & Company of Budapest, these being three-phase machines. The first gives 2,200 volts at 140 amperes, its engine being of the Erste Brunner make, and the second is somewhat smaller, giving 400 kilowatts at the same voltage; it is driven by a Lang engine. The total capacity of this section is 1,650 kilowatts, and for the engines, 3,700 horse-power.

The annex adjoining the main dynamo room is occupied partly by the Swiss machines and a number of interesting types are to be seen here. The Oerlikon Company has a three-phase alternator of 350 kilowatts and 1,000 volts, driven by a horizontal compound engine of the Escher-Wyss make; the exciter is mounted on the outer end of the shaft. A second Oerliken machine of 250 kilowatts and the same voltage is driven by a Sulzer engine of 400 horse-power. A third group consists of an Alioth 200 kilowatt generator and a Mertz engine of 360 horsepower. This section gives 800 kilowatts, the engines representing 1,660 horsepower.

On the ground floor of the Electrical Palace is an extensive collection of machine tools of representative American firms; most of the heavy American machinery will be shown in the Annex at Vincennes Park and will be described later. In the Transportation Palace a number of automobiles and cars of American make are shown. In the metallurgical section the Roebling Company has a large exhibit of electrical wires and cables. The handsome model of the Brooklyn



1.—In the German Section. 2.—The Great Borsig Engine.
3.—Great Crane in the French Section. 4.—In the Swiss Section.

Views in the Electrical Section, Paris Exposition.

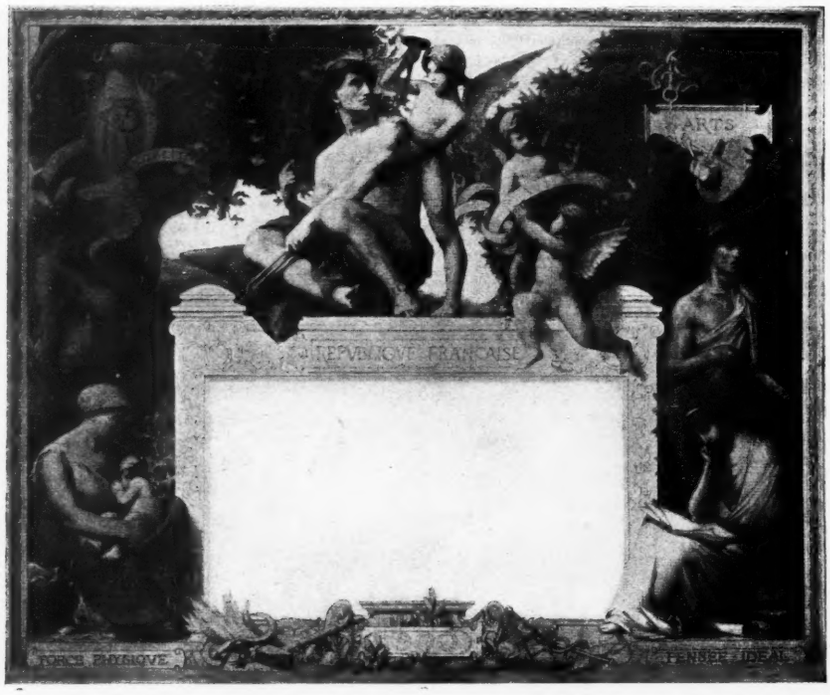
Bridge which this firm prepared for exhibition was lost in the wreck of the steamer Pauillac, but another model is now under construction.

The two boiler rooms occupy the space between the dynamo rooms and the adjoining building; the general arrangement may be seen in one of the illustrations. The steam piping is entirely underground, passing from the boilers to the corresponding dynamo rooms through masonry conduits. The view shows the boiler room corresponding to the French section, and here are to be seen a number of different makes, of the tubular or multitubular type, such as those of the Fives-Lille Company, Niclausse, etc. In the second boiler room are a number of German, Russian, Belgian and English makes. The railroad track passes through the centre of the building and the boilers are placed so as to face outwards, their fronts being in line. At the outer end of each boiler room is found the large smoke stack described on a preceding page, to which lead the underground conduits bringing the products of combustion, and passing along each side underneath the furnaces.

In another illustration is shown a general view of the main dynamo room devoted to machines of French manufacture. The large crane shown here is of the "Titan" pattern, constructed by A. Leblanc. The main body consists of a tower composed of four main beams braced horizontally and obliquely, forming a solid structure. It runs upon a wide track passing along the centre of the building, and is propelled by a rack and pinion system similar to the former. At the top of the tower is a revolving platform, supporting the horizontal cross-bar of trellis-work. The maximum course of the traveling carriage is 11 metres on either side; it is operated by a wire rope transmission from motors placed in the centre. The length of the cross-beam is about 25 metres. The current is taken by a trolley from a wire passing under the roof. The crane has a capacity of 25 tons and will lift to 12 or 13 metres.

The French section is to have an interesting collection of direct-connected groups, showing alternators and generators of the leading types. The largest of these is the alternator of 700 kilowatts, constructed by Schneider & Company, of Creusot; it has 80 internal poles mounted upon a large flywheel about 18 feet in diameter and two feet wide. The field is wound in slots on the interior of the outer ring, which has a diameter of 28 feet total. The width of iron utilized is about 12 inches. The alternator is three-phase and works normally at 3,000 volts. It is driven by a 1,500 horse-power engine of the Dujardin make, of the horizontal compound type. The Societe d'Eclairage Electrique has a 12-pole alternator of 300 kilowatts, working at 3,000 volts, and a smaller generator of 250 volts. The Thomson-Houston Company has a large alternator of 1,000 kilowatts, manufactured at Paris, by the Postel-Vinay Company; this is coupled to a Cail engine of 1,200 horse-power. The Postel-Vinay Company has another installation consisting of two generators of the railway type constructed upon the American model under the direction of Mr. E. M. Mix. The first of these is a compound-wound, eight-pole machine, giving 325 kilowatts at 550 volts and 90 revolutions; the second machine gives 75 kilowatts at the same voltage. A new arrangement of binding-wire has been adopted for the armatures of these machines.

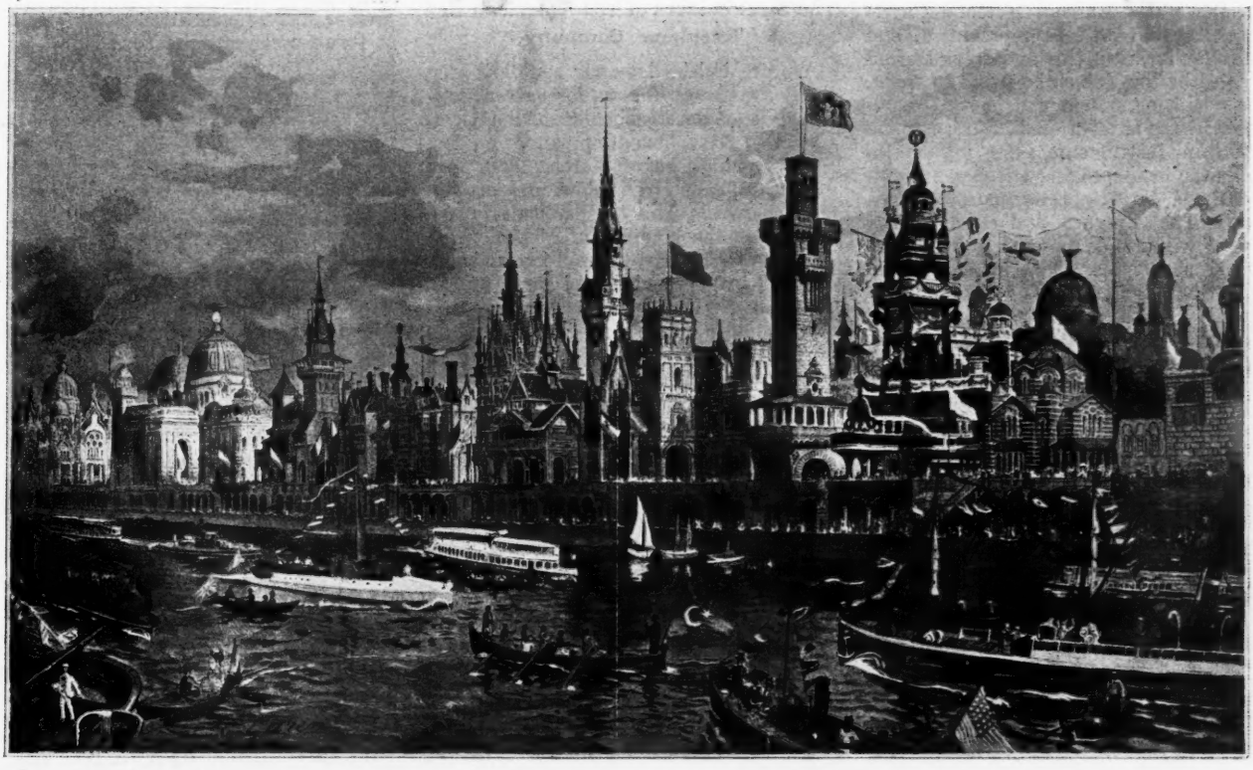
The Farcot Company has an 850-kilowatt alternator, coupled to a horizontal compound engine which has an extensive series of condensers, etc., placed below the floor level. The alternator has an external fixed armature, consisting of two rings, each of which has a series of polar projections carrying lathe-wound coils. The outer rings may be moved laterally so as to uncover the internal field, which is built upon a large fly-wheel and carries two series of projections corresponding to the



Diploma of the Paris Exposition of 1900.

"Electricity"—Decorative Panel in the Salle des Fêtes, Paris Exposition.

armature sections. The winding is of a novel type, consisting of a number of turns of heavy wire wound in a depression around the periphery and between the two series of polar projections. The alternator made by the Grammont Company gives 250 kilowatts at 2,200 volts, having an internal field carrying 80 pole pieces mounted upon the flywheel, the polar projections being about 8 by12 inches. The armature ring departs from the usual construction in that the winding is threaded through a series of large holes around the inner periphery, instead of the usual slots. One of the most interesting groups consists of a Laval steam turbine driving two small direct-current machines of the Breg-



TURKEY. UNITED STATES. GREAT BRITAIN. BELGIUM. NORWAY. GERMANY. SPAIN. SWEDEN. GREECE. SERVIA.

SOME OF THE NATIONAL PAVILIONS ON THE LEFT BANK OF THE SEINE, THE PARIS EXPOSITION.

net type. The turbine consists of a steel disk carrying upon its face near the periphery a series of oblique openings; it revolves at an unusually high speed, and the disk is made up of sections fastened together with a view of obtaining the maximum rigidity. The shaft carries on its outer end a steel pinion which engages with two large brass cylindrical gears, one on each side; each of the shafts is connected to a separate dynamo. In the present case, direct-current machines of 170 kilowatts each are used, working at 250 volts. The turbine is rated at 600 horsepower. The Maison Bregnet has also a triphase alternator of 500 kilowatts and 2,200 volts, driven by a Delaunay-Belleville engine of the upright compound type. Among the large alternators is that installed by the Fives-Lille Company, its exterior diameter being about 25 feet; it gives 400 kilowatts at 2,200 volts, being a three-phase machine. It is connected to a 1,200-horse-power engine of the horizontal type. The Weyher & Richemond Company has an interesting exhibit consisting of two 1,000-horse-power engines of the horizontal pattern, each driving a direct-current machine, the former of the Daydé & Pillé make, and the latter of the Electric and Hydraulic Company. Another engine of the same type drives a triphase alternator of 280 kilowatts. The total capacity of the groups in the French section which furnish light and power may be estimated at 10,000 kilowatts. Besides the larger units a number of small dynamos and motors are shown among the different exhibits, represented by the Postel-Vinay and Gramme Companies, the Maison Breguet and other prominent houses.

The second floor of the Electrical Palace and the wide galleries along the dynamo rooms contain the various electrical exhibits. The hexagonal Salon d'Honneur is to be largely devoted to the retrospective exhibit, and the French Government will have an extensive collection showing the progress of electrical science during the past hundred years. The United States will also have an interesting exhibit of this kind, relating to the history and development of the telegraph, telephone, electric lighting and traction, etc. The American national pavilion occupies the entire end of the second floor. It is a handsome structure built of white staff. It contains a series of arched entrances and colonnades in the Corinthian style. The colonnade is surmounted at intervals by a series of allegorical figures and eagles, and above each of the arches is mounted a large shield. The interior consists of a number of reception and exhibition rooms, and will be richly ornamented. Adjoining it is a smaller pavilion erected by the Allgemeine Elektricitäts Gesellschaft, of Germany. It is of plain construction but has a series of allegorical figures, in staff, of an interesting character; the pavilion is built mainly of staff, but is ornamented with designs in wrought iron and repoussee copper, which give a handsome effect. At the top is a dome composed mainly of wrought iron and metal work. Several of the other main pavilions are now in the course of erection, and the stalls and smaller pavilions for the exhibits are well advanced; the exhibits are being rapidly installed so as to be ready as soon as possible. Siemens & Halske have an extensive collection of apparatus of different kinds. Two pavilions of carved wood and stained glass of a rather novel character have been erected by the latter firm and by Shaffer & Budenberg, of Magdeberg-Buckau, which will contain a varied exhibit. The space devoted to the electrical exhibits is considerable, and a great number of

French, English, Swiss and other European firms will be represented, besides the American firms.

As far as can be judged at present, the exhibits promise to be of unusual interest, bringing together the most improved types of European and American apparatus, representing the development of electric lighting and power transmission, telegraphy, telephony, electrochemistry, etc. The telegraph apparatus will include transmitters and receivers of the latest patterns, and different duplex and multiplex systems will be shown. Among the latter is the Baudot printing telegraph which sends from four to six messages simultaneously; it is at present used extensively on the French Government system. Model telegraph offices will be seen, containing relays, calls, etc., of the latest patterns. The Marconi system of wireless telegraphy will be represented, and the latest forms of this apparatus as constructed by the French house of Ducretet. The telephone system will be well represented by the latest French, European and American instruments; the former includes the loud-speaking telephone recently designed by Messrs. Germain and Dussand. The Breguet and Postel-Vinay systems will also be represented by a number of new types. The installation of central telephone stations will be well exhibited with the new types of calls and automatic annunciators which have recently been perfected. The retrospective exhibition will include a number of documents and apparatus relating to the history of telegraphy; that of submarine cables will be well furnished and instructive; a series of telephones will also be seen, showing the development of the system.

The different types of arc and incandescent lamps will of course take an important place among the exhibits; among these will be the latest forms of the Nernst lamp. The Paris firm, Radiguet & Company, will show a collection of radiographic apparatus, tubes, induction coils and interrupters. The accumulator exhibition promises to be interesting, and the firms Fulmen, Pollak, Tudor, etc., will show different types especially designed for automobile work. The subject of electric clocks, railway signals, and like apparatus will be well represented by new models; among the latter Siemens & Halske will show several new models. The section devoted to electrochemistry and electrolytic products will have new types of electric furnaces. A new method of electric welding, which has been devised recently, will be shown, especially as applied to the welding of rails.

The exhibition of electromobiles promises to be especially interesting, as it will bring together the new European and American types, some of which have been perfected within a short time. These will be seen in the Civil Engineering and Transportation Palace, where a special section has been allotted to vehicles in general, including engines, cars, trucks, automobiles, etc. The electromobiles will be represented by the Jeantaud, Milde, American, Columbia, Riker, Siemens & Halske and numerous other makers. The American systems are to be well represented in this section. At the Parc de Vincennes a large space has been allotted to automobiles, and their practical operation may be observed upon the large race-track of 1,000 metres which has been laid out. The Automobile Club has arranged for a series of electromobile races during the Summer and Fall. At Vincennes Park is an extensive collection relating to electric traction, showing the latest types of motor cars, trucks, etc., of European and American design, besides a number of electric locomotives; that shown by the Paris-Mediterranean railroad is one of the most interesting.

Paris, April 18.

The Stockholders of the American Bell Telephone Company.

We are indebted to our contemporary, the Boston *News Bureau,* for a recent published list of the stockholders of the American Bell Telephone Company.

The comparison of March, 1900, with March, 1899, as given below, presents several changes. This is particularly noticeable in the holdings of Messrs. J. P. Morgan & Company, the well-known bankers of New York city, and those of Mr. Theodore N. Vail, who was formerly general manager of the American Bell Telephone Company, widely known in electrical and financial circles.

A rumor from Philadelphia is to the effect that the recent purchasers or the control of the Erie telephone interests have been quietly picking up the stock of the American Bell Telephone Company. This is not, as yet, substantiated.

The list of present stockholders is given below, comprising owners of 100 or more shares:

Holders.	1900	1899
Agassiz, Alex.,	573	573
Akin, Albert J.	...	825
Ayer, Fred....	1,168	878
Amory, Ed. L.	485	....
Brooks, Petr. C.	500	....
Barbour, Ed. D.	532	532
Bell, Mabel G..	1,500	1,500
Bigelow, John.	500	500
Blake Bros & Co.....	1,287	1,431
Blake, Anna S. C.....	729	729
Blake, Arthur West (est.)..	800	1,150
Blake, Francis.	700	700
Blake, Francis, tr.....	525	745
Bowditch, Ernest W.....	432	452
Bowditch. Jas. H.....	1,100	1.100
Brooks, J. H'y.	500	500
Cabot, Susan B.	810	810
Converse, E. S.	1,000	1,000
Childs, Wm. A.	629	629
Cochrane, Alex. & Co.....	1,070	1,070
Coolidge, T. Jefferson....	610	642
Cotton, Wm. C.	1,052	1,050
Crane, W. Murray.....	4,400	4,122
Crane, Zenas..	4,200	4,000
Crane, Fred G.	660	660
Cornish, T. E..	464	....
Curtis, Chas. P.	459	....
Dav. R. L. & Co.	1.342	....
Estabrook & Co	1.744	1.108
Fay, Jos. S. Jr.	1,100	1,050
Flagg, Augstus	609	550
Forbes, J. Mal.	363	500
Forbes, W. H. (est.).....	12	17
Forbes, E. E...	565	565
Forbes, Edith E., tr.....	250	250
Forbes, Ralph E., per. & tr.	380	375
Foss, E. N.....	600	600
Fuller, Rob. O.	440	....
Graham, J. M..	1,390	1,650
Gray, Horace.	1,025	1,025
Grew, Edw. S..	1,000	1,000
Grew, Hy. S...	370	670
Grew, Jane N..	580	880
Gardner, G.P.tr	126	500
Gannett, Thos. B.....	440	....
Gray, John C., tr.....	720	....
Head, Chas. & Co	1,635	....
Hubbard, G. Gardner (est)	....	500
Hubbard, Gertrude M	540	..
International Trust Co	10	650
Jackson & Curtis.....	538	874
Jacques. Kate S.	550	550
Lee Higginson & Co.....	327	674
Lowell, Augustus....	1,540	1,540
Lowell, Percv'l	1,696	1,696
Lyman, Arthur T., tr.....	690	790
Minot, William.	493	308
Minot, Wm., Jr., tr.....	627	185
Morgan, J. P., & Co.....	40	1,325
Moffat & White	1,405	....
E. Rollins Morse & Bro.	472	832
Norman. Geo. H. (est.).....	600	600
Parker, Moses G.....	799	774
Parkinson & Burr.....	625	....
Peabody, Geo. A., tr.....	840	840
Pickman, D. L., per. & tr.....	950	500
Pollok. Anthy. (est.).....	769	769
Prescott, E. C. per. & tr.....	1,388	985
Putnam, Geo..	457	....
Plummer, Geo. A. (est.).....	....	500
Scull, G. (est.).	717	717
Sewall, R. B ..	562	562
Sewall, W. B..	734	734
Spaulding, M. D. & J. P....	550	550
Stanley, F.F.tr.	1,807	1,807
Thomas, W. B.	550	550
Tower, Giddings & Co..	282	558
Tuckerman, L. S. tr.....	504	504
Tilotson, W. E.	600	....
Vail, Theo. N..	1,929	4,384
Vermilye & Co.	1,494	747
Watson, Thos. A.....	1,610	1,610
Wells, Chas. B.	425	425
White, W. A. & A. M.....	....	832
Williams, Chas. Jr.....	550	550
Wilkins, Walter P.....	....	....
Wright, Esther F.....	1,525	1,511
Wright, Mary F.....	1,000	1,000

It will be noticed that Governor W. Murray Crane, of Massachusetts, is now the largest stockholder of the company with 4,400 shares. It is stated that about 11,000 shares are held in brokerage offices.

The thirteen directors of the company, it is stated by our contemporary, now hold 3,501 shares compared with 3,730 in 1899. In 1896, the same board of directors held 7,770 shares.

The stock standing in the name of the present directors is given below, as well as for several years past:

	1900	1899	1898	1897	1896
Francis B'ake.....	700	700	700	700	824
Alex Cochrane (& Co.).	1,070	1,070	1,200	1,115	1,500
Henry S. Howe.....	121	121	121	110	110
Chas. Eustis Hubbard.	477	477	477	477	477
Jno. E. Hudson (president).....	15	15	15	15	15
Charles E. Perkins	400	400	400	388	450
Thomas Sanders.....	12	12	12	12	12
Moses Williams, tr....	133	226	226	192	155
C. W. Amory..	100	100	100	110	10
George L. Bradley....	..	..	..	..	..
T. Jefferson Coolidge, Jr.....	100	110	110	100	..
J Malcolm Forbes.....	363	500	1,033	1,732	1,721
Thomas B. Bailey.....	10	..	..	..	..

Wall Street and the Electrical Stock Market.

The general market during the week had a decided tendency toward recovery. The interest of the public is still largely restricted and the occasional animation in the market is furnished principally by the operations of certain pools in various stocks. Such manipulation as there is, is mainly on the bull side.

On the New York Stock Exchange, General Electric closed the week at 136¾ bid and 137 asked, a loss of 2 points for the week. Metropolitan Street Railway, of New York, closed at 158¾ bid and 159¼ asked, a gain of 1 point for the week. Third Avenue Railroad, of New York, closed at 107½ bid and 108 asked, a loss of 4½ points for the week. Brooklyn Rapid Transit closed at 74⅝ bid and 74⅞ asked, a gain of 1½ points for the week. Manhattan Railway, of New York, closed at 93¼ bid and 93¾ asked, a gain of ½ point for the week.

On the Boston exchange, American Bell Telephone closed at 340 bid and 344 asked, a gain of 15 points for the week. Erie Telephone closed at 102 bid and 104 asked, a loss of 1 point for the week.

On the Philadelphia exchange, Electric Storage Battery common closed at 80 bid and no asked price. Union Traction closed at 37½ bid and 37¾ asked, a loss of 1 point for the week. Electric Company of America closed at 11 bid and 11½ asked, a loss of ⅝ point for the week.

On the curb, or outside market, in New York, Electric Vehicle closed at 32 bid and 35 asked, a loss of 5 points for the week. Electric Boat closed at 24½ bid and 26 asked, a loss of 1 point for the week.

Wall street, April 28.

NOTES ON LIGHT.

BY WILLIAM ROLLINS.

NOTE XCV—TWIN X-LIGHT TUBES.

In previous notes the following statements were made:

The degree of the vacuum is not an index of the resistance of an X-light tube. Notes xxxiv, liii, lxxxix.

The cathode is not only a muzzle loading, but also a rapid fire magazine gun. Note lxviii.

Of the gas shot out from the terminals part will return and some will go into the walls of the tube.

Of the latter, a portion combines with the glass, giving it a purple tint; which can be removed by heat, the gas appearing in the tube again. Notes lxxvi, lxxvii.

These facts are again mentioned because by the aid of the simple tube shown in Fig. 74 they can easily be demonstrated. The tube is composed of two like bulbs blown from the same piece of tube at the same time. The metals for the terminals were cut from the same plates and rods, and are exactly alike. The targets are at the same distance. As the two bulbs compose a single air system, there must be the same vacuum in each, when in repose. When subjected to the same treatment, the amount and character of X-light was the same in each. I then treated bulb A so as greatly to increase its resistance. Bulb B was developed for good X-light. When excited the resistance was equal to 10 centimetres of dry air. The terminals of the same Ritchie coil (12-inch) were then attached to the loops of bulb A. The resistance was equal to 20 centimetres of dry air. In other words, while the vacuum was the same, the resistance of one bulb was at least twice as great as the other. That was a pleasing demonstration of the vanity of talking about the air spark as a measure of the amount of a vacuum. What caused this difference, which could be and was easily made greater? Chiefly this—in one bulb the terminals have been made more free from gas. Bulb B was next excited for a considerable time, the equivalent air resistance falling to five centimetres. The terminals from the coil were then attached to bulb A. The resistance in it had fallen to 10 centimetres of dry air. What had happened? Some of the gas from the terminals of bulb B had taken advantage of the opportunity and part had gone into the terminals of bulb A. Bulb A was then continued in an excited state for a long time, the resistance rising gradually to 20 centimetres again. What caused this rise when the vacuum was not rising? This—the gas was again being forced from the terminals and the current found less on which to ride that part of the field between the fronts of the terminals.

Now bulb A was heated, lowering the vacuum and the resistance. Then the other with the same result. What had lowered the vacuum? Gas, mostly hydrogen, from the glass. What had lowered the resistance? There were more particles in circulation to carry the current which now depended less upon the particles in the metal on which to ride across the field.

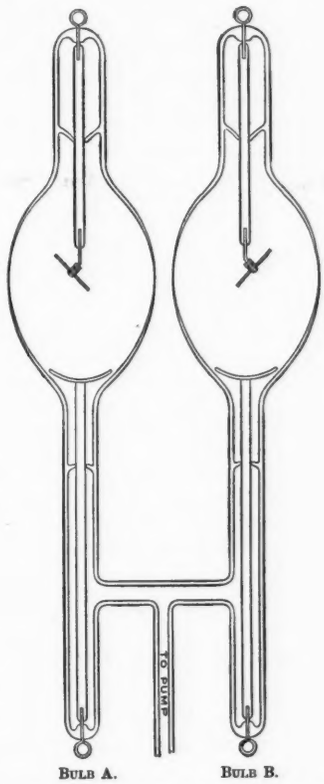


FIG. 74.—TWIN A-W-L ROTARY TARGET X-LIGHT TUBES.

As the vacuum was the same in these bulbs when at rest and practically the same for a few moments after the current started, we should have expected the character of the light to have been the same, if it depended upon the degree of the vacuum simply. Evidently then, as stated in Notes iii, vi, xviii, this is but one factor, for I could have in one bulb the kind of light which makes the bones as light as the flesh and in the other a light which gives great contrasts between them. What made this difference in the same vacuum? The charges on the particles of the Varley cathode stream were greater in one case, causing them to strike the target at a higher velocity. What caused the greater charge on the particles? The greater tension between the gas and the metal.

How does really lowering the degree of a vacuum affect the character of the X-light? By sending more particles into the circulation, the flying particles from the cathode meet with more obstruction on their way to the target, and the initial charge on each is lowered, because there are more to carry the amount of current, which therefore depends less upon the particles from the metal on which to ride the field. With the tube shown it was a simple matter to so exhaust one cathode that there was almost no X-light because only a fraction of the current rode the field in the direct path between the faces of the terminals, most of it being carried by the gas in circulation in the tube. To produce this condition it was only necessary to thoroughly exhaust the terminals and then while the tube was excited introduce fresh gas until the tube had a very low vacuum.

Quartz Thermometers.

It is well known that quartz becomes pasty before it melts, and M. A. Dufour has therefore tried to work it like ordinary glass. The point at which it begins to soften is between 1,000 degrees and 1,200 degrees, the temperature of the interior of the oxy-hydrogen blowpipe flame. The working of quartz has shown itself to be perfectly feasible, says the *Electrician*, and it may become an important substance where a highly refractory body is required which has a definite chemical constitution, is not hygrometric, can not be oxidized, and can not easily be reduced. Besides it always remains transparent, and does not, like glass, evolve gases on melting. The author's first application was to thermometry. He constructed a thermometer tube of quartz, and filled it with tin. It worked very well between 240 degrees and 580 degrees. The walls of the bulb had to be thick, as the solidifying tin otherwise pulled them together. The author is now making quartz vacuum tubes, which may possibly not occlude gases in their walls. It would then be possible to test the question as to what is the actual vehicle of vacuum discharges. Perhaps there is also an opening for incandescent lamps made of quartz.

The United Electric Light and Power Company, of Baltimore, has declared the regular annual dividend of two and one-half per cent on its preferred stock, payable May 1 to stock of record April 25. The company reports for the six months ending April 30 a surplus of $56,641.

EXPORT TRADE.

[*From the New York Journal of Commerce.*]

The time required for the development of foreign trade varies according to the conditions existing in and the distance of the country in which the products are to be introduced. For these reasons returns are liable to take from one to three years, and only manufacturers willing to allow such time to elapse can hope to finally succeed in their endeavors. Oftentimes manufacturers become discouraged after six months have been spent by their representatives abroad in trying to secure trade. They do not take into consideration that in the majority of foreign countries European competitors have held the field for years. In the Argentine Republic, for instance, it took an American axe manufacturer exactly two years to obtain his first order after having spent nearly $5,000 in endeavoring to introduce his wares. To-day the Argentine trade alone is worth all of $15,000 per year to the concern. Another instance was mentioned recently of an engineering concern which after two years and a half of hard struggle, succeeded in obtaining their first contract for engines in Japan. This happened some five years ago, and ever since that time, when a plant requiring such machinery as they furnish is to be put up they are surely asked for quotations. The means mostly employed by manufacturers and found by experience to be the most successful in introducing manufactured articles abroad is that of sending an intelligent traveler—one familiar with the particular country which he is to visit, knowing the language and customs. A technical man not having the above qualities, who is obliged to employ an interpreter, is said to be useless. Even under the most favorable circumstances in all probability the traveler will, in his first trip, only serve as an advance agent, paving the way for subsequent calls, at which time he may hope to transact business. To begin with, the first visit upon a buyer in a foreign country is for the purpose of explaining what his concern is desirous of doing, what terms are given, and how the merchandise offered compares with that which the buyer has been obtaining from another country, etc. If the merchandise offered for sale is admissible of furnishing samples, such samples are usually asked for, and if these meet the views of the purchasers at the end of a month, or possibly three, a sample order will be given. Indeed, lucky is the foreign traveler who, in the first six months of his trip, begins to show some returns by sending orders. Such cases have only been known when the traveler has had personal acquaintance among the people he is to call upon or when the merchandise offered is so apparently advantageous in both price and quality that to wait would mean the losing of a chance which might not exist a month later. Naturally a great deal depends upon the articles being introduced and the existing conditions of the country in which business is being pushed as to how soon sales will be made. There is one opinion prevailing among the manufacturers who have passed the introductory period of their wares abroad, and that is that foreign trade is to be counted upon at all seasons of the year. If business is dull in one part of the world it is surely active in another. Foreign business, they say, has kept their shops fully in operation when the domestic trade has been totally paralyzed, and furthermore, if a demand is created abroad through proper channels the success of a steady trade for years is assured. There is no need of a manufacturer transacting direct trade in foreign countries because he creates a demand abroad for his wares. Many concerns recommend their travelers to take orders only through local export firms, and thus waive all responsibility of direct accounts. By so doing, such manufacturers compel local exporters to purchase their products at the price quoted by the foreign buyer abroad, and this method, furthermore, lessens competition here, which is always created by the local exporter in order to serve his customer to the best advantage.

OUR CANADIAN LETTER.

SUNDERLAND, ONT.—An electric light plant may be established here.

DIGBY, N. S.—Major Daley intends to thoroughly overhaul the electric light plant here.

LONDON, ONT.—A project is on foot to build an electric railway from this city to Port Stanley.

BRACERBRIDGE, ONT.—The council will likely install an electric power plant and fire alarm system.

BROOKVILLE, ONT.—The town council proposes to utilize water-power for the electric light plant.

CANNINGTON, ONT.—The village council is about to take over and remodel the electric light plant.

DARMOUTH, N. S.—The council is considering the question of installing an electric light plant here.

LAKEFIELD, ONT.—The corporation is desirous of arranging for the installation of an electric light plant.

WINNIPEG, MAN.—The Bell Telephone Company propose extending their underground system in this city.

QUEBEC, QUE.—The Quebec Cold Storage Company want an assistant engineer who understands electric motors.

WOODSTOCK, ONT.—Dr. Ickes is advertising for 5,000 ties for the Woodstock & Thames Valley Electric Railway.

INGERSOLL, ONT.—The council has decided to grant a railway franchise to the Ingersoll Radial Electric Railway Company.

TORONTO, ONT.—The Bay of Quinto Railway Company is seeking authority to work mines and develop and supply electric power.

OTTAWA, ONT.—The Ottawa Electric Street Railway Company has had plans prepared for new sheds to be built of corrugated iron.

SELKIRK, MAN.—The Selkirk Electric Company has asked the Manitoba Government for a charter to build an electric railway from this town to Winnipeg.

ANNAPOLIS, N. S.—The Nova Scotia Electric Light Company has had a second survey made for the proposed water-power development in the Annapolis valley. It is understood that complete plans will be prepared at once.

NIAGARA FALLS, ONT.—The Ontario Power Company has signed a contract with the commissioners of the Queen Victoria Park, and it is intended to commence development work immediately. The estimated cost is placed at $2,000,000. H. C. Symmes and R. Paine, of this place, are interested.

TORONTO JUNCTION, ONT.—W. T. Stewart, electrical engineer of Toronto, has submitted to the council his report regarding the required changes in the lighting system of the town. It is expected that in the near future some action towards the installation of a new plant will be taken by the council.

TORONTO, ONT.—A proposal has been made to the city council to establish a comprehensive system of electric railways, embracing the country around Toronto, between Brantford, Peterboro and Georgian Bay. The scheme involves a total mileage of 354 miles, and an expenditure for tracks and roadway only, of $285,000.

HULL, QUE.—Sealed tenders endorsed "Electric Light Tenders" will be received by R. W. Farley, city engineer, for: 1. 75 direct-current series enclosed or long-burning arc lamps. 2. 75 alternating-current series enclosed or long-burning arc lamps. 3. Double-braided weather-proof line wire (8 or 10 miles). 4. The whole f. o. b. Ottawa or Hull. The right to reject any or all tenders reserved.

VANCOUVER, B. C.—The Stave Lake Power Company, Limited, has been incorporated with a capital of $1,000,000. The company has acquired a waterfall on Stave River, 42 miles from this city, and propose to generate power and transmit it to Vancouver. The hydraulic engineer of the company is Chas. A. Stoess and the electrical engineer is Geo. C. Hinton. John Henley, manager of the Hastings saw-mills, is one of the directors. The estimated cost of the work is $500,000.

J. A. C.

Montreal, April 25.

SCIENCE BREVITIES

High Frequency Currents and Consumption—In a note presented to the French Academy of Sciences, M. E. Dollmer describes various curious facts which seem to demonstrate an improvement in the condition of tuberculous patients subjected to high-frequency currents. After five or six applications the nightly sweats diminish and totally disappear after about 15 applications. An examination shows a systematic diminution of the number of bacteria present in the sputa. After long treatment the appetite is said to return, emaciation is stopped and the weight of the body increases. Experiments were made upon 27 patients of both sexes suffering with various stages of the disease and the author is led to believe that the constancy and clearness of the observed results leaves no opportunity for doubt that the results are actually accomplished as stated. He will describe later the method of applying the current.

Electrical Crystallization—The following is an abstract of a paper contributed by Mr. T. Tommasina to the *Comptes Rendus*: When an electric current of less than one milliampere is sent through flat zinc electrodes placed in distilled water, the electrodes being very close to each other, well-defined crystals of metallic zinc are deposited. At first no gas is evolved, but after the action has been going on for some time, there is an evolution of gas from the cathode, the electrodes become oxidized, and the deposition of the metal ceases. If the anode is removed, cleaned, and then replaced, the action begins again. With a copper plate as cathode, and a zinc anode, crystals of zinc are deposited on the copper. Similar results were obtained with silver and cadmium. If the two electrodes are too widely separated, then a kind of haze appears between them; this contains very small, metallic crystals, which are arranged in a chain-like form.

Thermography—A remarkable series of experiments is described by Herr R. E. Liesegang in the *Physikalische Zeitschrift*. If a mixture is made of equal parts of hydrochinone and dry sodium carbonate and the mixture is dampened with alcohol so that the powder becomes pasty the surface of it becomes in a moment of an intense dark blue color. This blue substance possesses a remarkable sensitiveness to radiant heat. If the mixture is spread on a piece of paper and is all wiped off except what adheres to the paper, the blue color soon appears. If this is exposed to the radiation of a gas oven, it is bleached completely within five seconds. Coins, etc., placed upon it leave their shadows in the blue color. The author says that he does not know of any photographic preparation which changes color so rapidly under the action of light as this substance does under the action of heat rays. By the normal oxidation in the atmosphere of hydrochinone and an alkali, a brown color appears. The blue substance appears to be a half-way step toward this. Wetting it with alcohol or water immediately dissipates the appearance, which does not return upon drying. Ether has no effect upon it. The sensitive paper can be kept only a few days.

Electro-Culture—The results obtained by culture under the influence of electric light are fairly well known, and the growlight are fairly well-known, and the growhouses, with the aid of electric light, is already a profitable industrial pursuit. However, the use of electric currents for stimulating vegetation, although it was studied more than fifty years ago, still remains unsettled. A communication upon this subject, made by a Russian engineer, V. A. Tyurin, before the St. Petersburg Electro-Technical Society, contains some welcome information upon the work done in this direction in Russia by M. Spyeshneff and M. Kravkoff. The former experimented a few years ago on three different lines. Repeating well-known experiments on electrified seeds, he ascertained once more that such seeds germinated much more rapidly, and gave better fruit and better crops (from two and one-half to six times higher) than seeds that had not been submitted to preliminary electrification. Repeating next the experiments of Ross—that is, burying in the soil one copper and one zinc plate, placed vertically and connected by a wire, he found that potatoes and roots grown in the electrified space gave crops three times heavier than those which were grown close by on a test plot; the carrots attained a quite unusual size, of from 10 to 12 inches in diameter. Spyeshneff's third series of experiments was more original. He planted on his experimental plot, about ten yards apart, wooden posts, provided at their tops with metallic aigrettes connected together by wires, so as to cultivate his plants under a sort of network of wires. He obtained some striking results, one of which was that the growth and the ripening of barley were accelerated by 12 days. Quite recently M. Kravkoff undertook a series of laboratory experiments upon boxes of soil submitted to electric currents. The temperature of the soil was raised by these currents; its moisture decreased first, but began to increase after a course of three weeks (the same increase of moisture was also noticed by Fichtner); and finally, the amount of vegetable matter in the soil was increased by the electric currents. With what is now known upon the influence of micro-organisms upon vegetation, further research on similar lines is most desirable and very promising.

Contact Electricity—M. E. Pierard contributes to the February number of the *Bulletin de la Societe Belge d'Electriciens* the result of some curious experiments in telephoning without a battery or other source of electricity. In these experiments a vibrating diaphragm carrying on the back a small platinum disk was so arranged as to touch, when vibrating, the platinum point of a screw at the back of the diaphragm. When the telephone was connected to the screw and the diaphragm respectively, the apparatus was found to transmit musical sounds with distinctness. The effect in the receiving telephone could also be increased by means of an induction coil. The author proceeds to analyze the experiments in order to ascertain whether the currents resulted from a Volta effect or from a thermo-electric effect. With the first object he tried a number of diaphragms with and without the platinum contact at the back. The best results were got with a plate of argentan—an alloy of copper, nickel and zinc. This diaphragm had a thickness of 0.194 millimetres. Without the platinum contact at the back no sounds were audible, but as soon as this was added the diaphragm acted exceeding well, even better than the first diaphragm, which was made of tinned iron. The addition of the platinum in the centre of the plate, says the London *Electrical Engineer,* was proved to be not merely a mechanical advantage by reversing the diaphragm so that the screw contact came against the surface of the alloy. A diaphragm of copper did not act so well as the above, but here again the addition of the platinum contact had an advantage. A diaphragm of zinc gave very poor results, and with a diaphragm of aluminum no sounds could be heard. An iron diaphragm also did not act well except when the platinum contact was added. To prove that it was not a thermal effect, the whole apparatus was kept at one temperature, and the sound was made by the vibration of a rod of wood, which acted just as well as when speaking or singing into the apparatus. The author, after other experiments, concluded that the action was due to contact electricity and to the small currents resulting therefrom when the connection between the two platinum points was made and broken. This is another instance of the exceedingly small currents which an ordinary telephone is able to detect.

Gutta-Percha and the Proposed Pacific Cable.*

Some facts of interest relative to the cost of construction of ocean cables are contained in a communication to the senate committee on naval affairs by Mr. Harrington Emerson, of Philadelphia, who favors what he calls the northern route for a cable across the Pacific. Instead of going by way of Hawaii and the Philippines to reach Asia, he favors connections to Alaska, Siberia, Japan and the Philippines, for the reason, among others, that thereby shorter stretches of cable will be needed than under any other plan than has yet been suggested. No matter what plan or route may be adopted, several stretches of cable will be necessary, and every one of these stretches varies in length. "If economy is an object," says Mr. Emerson, "each stretch requires a different type of cable." In other portions of his report Mr. Emerson says: "A standard modern cable with a speed of 40 words a minute must have a core of 500 pounds of copper and 320 pounds of insulation [per mile] on a stretch of 2,200 miles. . . . A cable of 107 pounds of copper and 140 of insulation is the standard for distances up to 1,000 miles."

From other portions of Mr. Emerson's communication, the further figures which follow have been compiled:

"On the southern cable route, *via* Midway, the links are:

	Miles.	Copper.	Gutta-percha.
San Francisco to Hawaii	2,390	500 lbs.	320 lbs.
Hawaii to Midway	1,311	250 "	250 "
Midway to Guam	2,638	650 "	400 "
Guam to Luzon	1,564	300 "	300 "
Total and average	7,903	470 lbs.	390 lbs.

"The 1894 Anglo-American cable, with a length of only 1,850 miles, and with 650 pounds of copper and 400 pounds of gutta-percha, gives a speed of 47 words a minute."

On the basis of the figures given above for the Hawaiian route there would be required a total of 3,700,000 pounds of copper and 2,600,000 pounds of gutta-percha. On the northern route, according to Mr. Emerson, for the longest stretch the standard type is 107 pounds of copper and 140 pounds of gutta-percha per mile, which could probably be reduced to 107 pounds of copper and 120 pounds of insulation per mile. "The larger figures give a total of 454,000 pounds of copper and 686,000 pounds of gutta-percha, or one-eighth as much copper, and one-quarter as much insulation as the route *via* Hawaii.

"It is here to be noted," says Mr. Emerson, "that india-rubber is quite as good an insulation as gutta-percha on cables not exceeding 1,000 miles. The Great Northern Telegraph Company, which owns and operates over 7,000 miles of cable, half of it in Asiatic waters, uses rubber almost wholly. Gutta-percha is used [by them] on long and very deep sea cables."

Mr. Emerson's report contains the following statement of details of the construction of other important cable lines which are of interest in connection with the cost of cables.

The 1894 Mackay-Bennett cable, 2,200 miles long, is made up of an average of:

Copper	500 lbs.	worth	$100
Gutta-percha	320 "	"	640
Jute	585 "	"	60
Steel	3,054 "	"	300
Compound	1,100 "	"	110
Total	5,556 lbs.	per mile	$1,210

The Penang and Rangoon cable, 583 miles long, is made up of:

Copper	107 lbs.	worth	$22
Gutta-percha	140 "	"	280
Jute	220 "	"	20
Compound	660 "	"	66
Iron wire	2, 50 "	"	112
Total	3,250 lbs	per mile	$500

It is only fair to state that the Penang cable is an old type made in 1877 and that, in modern practice, rubber would be used instead of gutta-percha, steel wire instead of iron, reducing the quantity to 1,000 pounds, and diminishing also the amount of jute and compound.

"When the British commission considered the British cable from Vancouver to New Zealand, one of the greatest obstacles encountered was the scarcity of gutta-percha. The supply of this material is limited, as the trees are destroyed in the gathering of the sap, and each year new sources of supply have to be discovered. As a consequence, quality varies and price is high—over two dollars a pound. Nothing but gutta-percha can be used on the long stretches of the southern (Hawaiian) route. There is not enough gutta-percha obtainable to maintain existing cables and provide for either the American or British Pacific cable. The northern route requires only one-fourth as much gutta-percha, but can also use rubber as an equally good alternative, and refined rubber costs but $1.30 a pound (on the basis of fine old Para at $1.10 a pound, crude). The smaller quantity of insulation required, but a fraction of the annual supply of rubber . . . . . would not make it possible to corner the market of insulating material."

Mr. Emerson, in view of what his investigations have brought to light, favors a Pacific cable by the northern route with a wholly independent route from the United States to Hawaii. "On this basis, the combination of Hawaiian and all-American northern route figures out as follows: Total copper, about 2,000,000 pounds; Gutta-percha, about 1,500,000. The types and links of cable are:

Stations.	Length.	Copper per mile.	Gutta percha per mile.
United States to Attu	3,100	107	140
Attu to Isle	2,000	400	360
Isle to Luzon	1,800	130	130
Isle to Japan	300	107	140
San Francisco to Hawaii	2,300	130	130

"Total copper, 1,696,800; total gutta-percha, 1,729,000."

On the basis of all the computations made, Mr. Emerson tabulates the three principal proposals for a Pacific cable as follows, with reference to the requirements for insulating material:

	Copper.	Gutta-percha.
The all-American route via Hawaii, and nothing to Alaska	3,700,000	2,600,000
The all-American route via Dutch Harbor, including separate cable to Hawaii	1,700,000	1,720,000
The American-Japan route to Manila	500,000	700,000

* From the *India-Rubber World.*

AUTOMOBILES

The New Jersey Electric Vehicle Transportation Company has arranged to install automobile stations during the coming season at the following points on the New Jersey coast: Sea Bright, West End (Long Branch), Allenhurst, Spring Lake and Atlantic City. At each of these stations Columbia vehicles, both electric and gasoline, of various designs will be for sale, and a specialty will be made of charging and caring for Columbia automobiles owned by private parties. The location of the various stations insures proper accommodations for vehicles and offers a large field for driving. Park wagonettes and omnibuses will be available for special service and for parties wishing to make trips through the surrounding country.

A new company has been formed at Bordeaux, called the Bordeaux Automobile Transportation Company, which will carry freight over a part of its route upon heavy automobiles of special construction. This company has been formed in connection with the Automobile Courier and Transportation Company. Its principal object is to transport, between Bordeaux and Mazamet, the sheep's hides brought to that port from America and Australia, and on the return trip to bring the wool and leather produced at the latter point to Bordeaux, from which is is shipped to Antwerp and Liverpool. To carry out the system proposed by the company, says the *Scientific American,* the hides will be uploaded from the transatlantic steamers into freight boats, which will pass up the Garonne to the lateral canal and the Canal du Midi to the Point Rogue. From there they will be transferred to the automobile wagons, which will travel over the national route to Mazamet, thus delivering the hides directly to the merchants of that district. The route passed over by the automobiles will be about 41 kilometres. The company estimates that four or five automobiles will be sufficient, on a basis of 12,000 tons annually.

Prize for Electric Railroad Specifications.

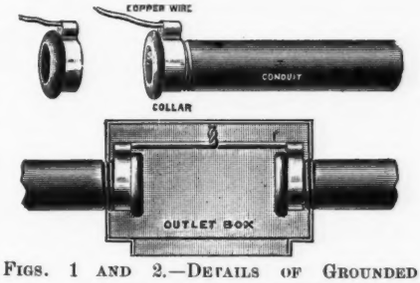
The German Society of Mechanical Engineers will this year award the Veitmeyer prize of 1,200 marks, with gold medal, for the best plan and specifications for an electric railroad between two distant cities, designed exclusively for trains running at a speed of 200 kilometres (124¼ miles) per hour, and following each other in quick succession without intermediate stopping points, each train to have a minimum capacity of 150 passengers. The stipulations are given in full in the January number of Glaser's *Annalen,* and the contest will close on October 6, this year. The prize will be awarded at the November meeting of the society. Concerning the subject selected, Mr. Wichert, one of the prize judges, and a leading German Government engineer, writes as follows: "The problem has a special interest at the present time, as the new century now dawning may see its practical solution. The construction of railroads especially designed for light trains of high frequency and enormous speed has so far received only passing attention. Look at it as you will, it is in line with the progress of the times; but whether a practical solution is possible or not, time, study and experiments alone can demonstrate. The subject requires that careful consideration be given to the designs of terminals with the necessary installations for handling trains of 200 kilometres' speed without risk or confusion. As such speeds have never yet been attained, the problem may bring out the impossibilities, if any, which stand in the way of solving it. No definite distances being laid down, the solution will not give absolute, but only relative quantities. Correct theories ought to be developed in regard to the resistance at high speeds, which in the United States have already reached 150 kilometres per hour. The problem, must, therefore, be based on an unprejudiced review of the literature and the material at hand in such matters as train and air resistance, brake action, etc., referred to high speeds; and the committee having the subject in charge thinks that there is still a wide field unexplored in that direction."

Grounding Metal Conduits.

The two accompanying illustrations of the "Seco" ground connection and bushing, manufactured by the Specialty Electric Company, Brooklyn, N. Y., show the device itself in Fig. 1, and its application in Fig. 2.

This ground connection and bushing is designed to meet both the following requirements in the latest rules of the National Board of Fire Underwriters: "Metal conduits, where they enter junction boxes, and at all other outlets, etc., must be fitted with a capping of approved insulating material, fitted so as to protect wire from abrasion. Must have the metal of the conduit permanently and effectually grounded." The local rules in the larger cities also require the above.

To meet the first requirement, a neat, substantial insulating bushing is fitted to the end of the conduit by a collar, as shown in Fig. 1. The second requirement is met by connecting together the wires from the different conduit ends at each junction box, outlet box, etc., as shown in Fig. 2, thus bonding together all the conduits throughout a building



FIGS. 1 AND 2.—DETAILS OF GROUNDED METALLIC CONDUIT SYSTEM.

and making one earth connection sufficient to permanently and effectually ground the entire conduit system.

It is supposed by some that the iron conduits in a building are necessarily grounded, but this is a most unwarranted assumption. The metallic continuity is broken at each outlet, cut-out box, etc. (particularly with enameled conduits—the enamel being an insulating substance), and doubtless fires have been due to the fact that conduits are not grounded throughout, as required. The apparent ground is usually caused by wet plaster in new buildings, and generally disappears when the plaster dries, or the ground remains on part of the conduit system only. The fact that the neutral wire is grounded on all three-wire systems and bids fair to be openly permitted in the near future, emphasizes the necessity of grounding the conduit throughout in order to take care of a wire that may become grounded in the conduit; and, perhaps, the failure of the inspection bureaus to enforce this requirement, will explain the cause of some of the "mysterious" fires in buildings employing the conduit system of wiring which is now the standard method. Then, too, when the conduits are properly bonded together and grounded, the leakage so noticeable in this class of wiring is guarded against, as the fuse is promptly blown when the insulation of the wire is impaired. The success of all systems depends largely on the attention to small but substantial details, as all experienced contractors know, and, doubtless, they will be the first to profit by this new improvement.

VIEWS, NEWS AND INTERVIEWS

The only kind of an automobile hearse that has yet been built is one to carry to the cemetery of blasted hopes the corpse of dead ideas and the ashes of incinerated coin of the realm.

Miss Annie Rainsford French, who is well-known in New York social circles, and whose profile adorns the brass tablet of the cruiser Olympia, has just been granted an engineer's license by the District of Columbia Commissioners, says the *Washington Post.* She is the first duly qualified woman engineer in the capitol city. Miss French does not aspire to be a mechanical engineer, other than to run her own automobile, although she has taken the regular examination, which tests her qualification for such a position.

United States Consul Thackara, of Havre, reports that a new submarine telegraphic cable has been laid between Havre (St. Denis Chef de Caux) and Cuckmen, near Beachy Head, England, by the steamship Brittania, for the Anglo-American Telegraph Company. The length of the cable is 81.3 knots. The land connections in England and France are almost completed. As soon as the new cable has been connected with its London wire, the Brest cable will no longer be used by the Anglo-American Telegraph Company.

In 1871, the first section of the New York elevated system was constructed and put in operation in the following year. In that year, according to William Barclay Parsons, in *Scribner's Magazine,* the number of passengers carried on all the surface and elevated railroads was 138,867,000. In 1882, the total had risen to 252,800,000; in 1892, to 453,200,000; while in 1899 it was still further increased to 528,228,437, and rapidly growing. These figures are for the old city of New York, now known as the Boroughs of Manhattan and Bronx, and are for paying passengers only. In 1899, there were transferred passengers amounting to 159,560,822, not included in the above. It is interesting to note in comparison that for 1898 the United States Interstate Commerce Commission reports that there were carried on all the steam railways in the United States, from the Atlantic to the Pacific, from the St. Lawrence to the Rio Grande, passengers to the number of 501,066,681, or five per cent less than the number carried by the New York city surface and elevated railways alone.

Annual Report of the Chicago Edison Company.

The report of the Chicago Edison Company for the year ending March 31, 1900, shows an increase of about 10 per cent in net earnings over the preceding year, which year had shown the largest earnings in the history of the company to that time. Gross earnings for the 12 months ending March last were practically the same as for the 15 months ending March 31, 1894, including the entire World's Fair period. A dollar in gross earnings this year represents a considerably greater output of current than in 1893, owing to the steady reduction of price to the consumer. Nevertheless, the net earnings for the last 12 months were $130,000 greater than for the 15 months of the World's Fair year—with gross, as stated, practically the same, and with a larger output of current. This tells its own story as to cheap production of current.

There was no increase in the company's funded debt during the year. The balance sheet, however, shows an increase of $995,200 in capital stock outstanding. This is the $1,000,000 issued February 1, 1900, so that no dividends were paid on it in the fiscal year under review. This new stock increases the dividend requirement the current year by $80,000 Last year's surplus, after all dividends and charges, amounted to $149,074, of which $60,000 was carried to depreciation reserve account and $8,000 to insurance reserve, leaving $81,000 to go to surplus account, being more than equal to the increased dividend requirement for this year. Earnings and balance sheet show as follows:

EARNINGS.

Year ending March 31:	1900.	1899.	Inc.
Gross income from current and merchandise sales..	$2,133,827	$1,954,877	$178,950
Operating expenses, repairs and renewals	1,321,437	1,214,621	106.816
Net income.....	$812,390	$740,256	$72,134
Bond and debenture interest.	265,243	262,524	2,719
Earned on stock.....	$547,147	$477,732	$69,415
Dividends paid.....	398,072	398,072	.....
Balance.....	$149,075	$78,660	$69,415

COMPARISON, EIGHT YEARS.

Year.	Gross.	Net.	Interest.	Earned on stock.	Dividends.
1899-1900..	$2,133,927	$812,390	$265,243	$547,147	$398,072
1898-99....	1,954,877	740,256	262,524	477,732	398,072
1897-98....	1,661,863	676,525	226,681	449,844	398,072
1896-97....	1,548,608	599,874	180,334	419,340	397,518
1895-96....	1,461,084	562,567	158,135	404,432	389,382
1894-95....	1,437,042	483,665	155,128	328,537	319,038
1893-94....	2,141,779	680,677	171,934	508,743	219,119
1892.....	872,665	327,854	6,798	321,056	90,000

NOTE.—Prior to 1893 the fiscal year was the same as the calendar year. Figures for 1893-94 include fifteen months.

BALANCE SHEET, MARCH 31.

ASSETS.

	1900.	1899.	Changes.
Plants, real estate and franchises....	$10,817,676	$10,098,421	Inc. $719,255
Material and unfinished work.....	236,485	180,214	Inc. 56,271
Accounts and notes receivable..... ..	435,920	237,433	Inc. 198,487
Cash.....	65,261	79,085	Dec. 13,824
	$11,555,342	$10,595,153	Inc. $960,189

LIABILITIES.

Capital stock.....	$5,971,100	$4,975,900	Inc. $995,200
Bonds and debentures.....	4,808,000	4,808,000	.....
Accounts and notes payable	160,016	332,462	Dec. 172,446
Depreciation reserve	350,000	290,000	Inc. 60,000
Insurance fund.....	44.000	36,000	Inc. 8,000
Surplus account.....	182,773	101,698	Inc. 81,075
Open account.....	39,453	51,092	Dec. 11,639
	$11,555,342	$10,595,153	Inc. $960,189

BUSINESS CONNECTED.

Total equivalent in 16-candle-power lamps, March 31, 1900.....	594,202
Total equivalent in 16-candle-power lamps, March 31, 1899...	489,583
Increase for fiscal year.....	104,619

Depreciation reserve amounts to $350,000, it will be seen. This is the fund created under that clause of the mortgage which provides that the company shall annually expend in repairs and renewals not less than $190,000, and over and above such sums annually expended for repairs and renewals, it shall make certain credits to depreciation reserve account, beginning with $200,000 October 15, 1896, against which account it can charge the actual cost of bona fide extensions. This account, therefore, is really a sinking fund, except that the money, instead of being applied to cancel bonds, may be used for actual extensions of the plant; and it is not a depreciations account in the ordinary sense of that term. All ordinary repairs and renewals are charged against earnings in each year, and the whole plant is admittedly kept in a very high state of efficiency. During the year just closed the company has completed the improvements to the Adams street building, giving, in addition to much improved office facilities, capacity for 6,000 horse-power storage batteries. Four thousand horse-power has already been installed. It has also installed a storage battery at the Twenty-sixth street station and increased the capacity of the Market street plant by 1,500 horse-power. The principal underground work has been on the West side, from Harrison street to Lake, and from Halstead street to the river. The extension of underground conduits in this manufacturing section has been for the purpose of supplying a largely increased demand for current for power. During the current year some important improvements will be made in the big Harrison street station.

Copper Production of the World.

[*From the Engineering and Mining Journal.*]

We give below the figures for the copper production of the world for the year 1899. For most foreign countries these are the figures presented by Messrs. Henry R. Merton & Company in ther usual yearly circular, which has been sent out this year with commendable promptitude. Messrs. Merton have so long compiled these statistics, and are in such close touch with the copper trade and production that their approximations for those countries which do not publish exact statistics are very close. In the case of the United States we have substituted the figures which were collected for the statistical number of the *Engineering and Mining Journal,* and for Canada those which are given by the Geological Survey of the Dominion. These figures are compared with those given in *The Mineral Industry,* Volume VII, for 1898. The figures are in long tons:

	1898.	1899.
Algeria.....	50	.
Argentina.....	125	65
Australasia.....	18,000	20,750
Austria-Hungary.....	1,540	1,505
Bolivia.....	2,050	2,500
Canada.....	8,040	6,732
Cape of Good Hope.....	7,060	6,490
Chile.....	24,850	25,000
Germany.....	20,085	23,060
Great Britain.....	550	500
Italy.....	3,425	3,000
Japan.....	25,175	27,260
Mexico.....	15,668	19,335
Newfoundland	2,100	2,700
Norway.....	3,615	3,610
Peru.....	3,040	5,165
Russia.....	6,000	6,000
Spain and Portgual.....	53,225	53,720
Sweden.....	480	520
Total foreign.....	195,088	208,662
United States	239,241	265,166
Totals.....	434,329	473,818
Totals, metric tons.....	441,278	481,399

We have heretofore commented on the production of the United States. Among the other important producers the changes are not so great as might have been expected during a period of very high prices, but we must again recall the fact—of which this is a further illustration—that copper production can not be increased at short notice. The output of existing mines may, perhaps, be urged for a time, but the opening of new copper deposits involves as a rule much time and a large expenditure of money.

The most important gains shown by the larger producers outside of the United States are 3,667 tons in Mexico, where some important copper districts are being opened—a few having begun to produce already; 3,375 tons in Germany, of which 2,745 was from the Mansfield mines; and 2,385 tons from Japan, this advance being made notwithstanding the stoppage of production in one of the largest mines in the country, the Besshi. Work on the other mines, however, seems to have been pushed. In Spain the production shows but little change. The Rio Tinto increased its production only 665 tons for the year, while the Tharsis and Sevilla, as well as the Mason & Barry, in Portugal, show little change. In Australasia a gain of 2,750 tons is estimated, a large part of which came from the Mount Lyell mine, in Tasmania. The Cape Copper Company shows an actual decrease in the output from its African mines.

The increase in the total supply is not far from 10 per cent, which has been the average rate of gain in copper production for several years past. It is quite possible that 1900 will show a greater gain, although we do not look for the full results of the increase in consumption until next year.

Modern Central Station Practice.

At the April meeting of the electrical section of the Franklin Institute Mr. Chas. F. Scott, of Pittsburgh, presented a paper on "Modern Central Station Practice." Mr. Scott pointed out that the word "modern" in this connection must refer to the last four or five years, as the "ancient" in central stations dates back only a score of years. The bitter controversy between alternating current and direct current which prevailed 10 or 12 years ago has been renewed in another form. The direct current has had a fairly well defined field in centres of cities, while the alternating current has not only found favor in towns and outlying districts where areas are wide, but has also been used extensively in city distribution as well.

In the new engineering which is made necessary by the extension and combination of electric interests, it is essential to generate power in large stations favorably located. Direct-current distribution therefore demands an alternating-current power station, distributing to sub-stations, where the current is converted into direct current by rotary converters. The question then arises whether it is better to convert into direct current or to distribute the alternating current without the intervening machinery with its inherent losses and the complications in operation which are involved if the current is converted into direct current. The various pieces of apparatus, including generators, rotary converters and motors which are used in connection with the central station system were then taken up in detail. The most recent types of construction were illustrated and explained, and particular attention was given to those characteristics which are of particular engineering interest and which bear particularly upon the choice between direct-current and alternating-current distribution.

In connection with the parallel operation of alternators a mechanical analogue was presented in the form of two engines which drive a common load through gear wheels which are connected with pinions on a common shaft, instead of alternators which are connected to common bus-bars. It was pointed out that the operation of the engines, both as to the manner in which they may be first connected together, the conditions relative to division of load and to the shifting of load between the two engines, are the same in most respects whether the engines be connected by gear wheels or alternators.

Some interesting facts respecting the operation of rotaries, particularly as to "hunting," were presented, together with the means which are effective in counteracting the various tendencies to this action. It was stated that the better class of rotaries are now operating with the same high standard of excellence which characterize other types of electrical apparatus.

The old controversy between the induction and the synchronous motor is rapidly dying out, as there are few, if any, who advocate the synchronous motor for small work, while the dividing line in size between the field where induction motors are universally accepted and that in which there is still some difference of opinion is rising. Mr. Scott stated that he thought it quite certain that the induction motor would not wholly replace the synchronous motor, as there are some few conditions under which some of its features are of sufficient value more than to compensate for its many objectionable elements. The adaptability of the induction motor to general service of a city where simplicity and reliability are of paramount importance was explained and it was pointed out that while reliability rather than efficiency is the important element, yet the efficiency of the induction motor is practically the same as that of the direct-current motor at full load, it is higher at small loads, particularly in small sizes, where the brush friction of direct-current motors is comparatively high.

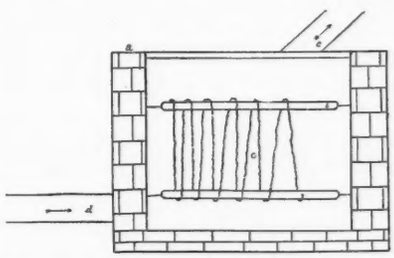


DIAGRAM SHOWING METHOD OF ELECTRICAL THEATRE HEATING.

The characteristics of alternating-current apparatus make it, in many respects, the ideal form for use throughout the whole of a city plant. The difficulty which confronts the engineer at the present moment is the necessity of using various existing apparatus in a comprehensive system while at the same time he may be working forward to ultimately reach the system which will possess the greatest simplicity, reliability and economy in its operation.

When shall we have an automobile corps in the National Guard? Then the shortage of street car horses won't cause any trouble.—*New York Evening Sun.*

AN ELECTRICALLY HEATED THEATRE.

BY F. W. JONES.

The sketch below represents a method that has been adopted for heating the Odeon Theatre, on the Calle Esmeralda, in Buenos Ayres. While there is little use for heating apparatus in public places in the climate of Buenos Ayres, the experiment was tried with gratifying results at the theatre and the method used was of the simplest.

In a square brick oven-shaped box with an iron door on one side there are arranged warm air pipes leading up to the registers in the floor of the theatre and an air duct coming in from outside. This arrangement is in the cellar. In it are resistances made of coiled iron wire, No. 10 gauge, wound around slate frames as shown in the sketch. There are four series of the coils each controlled by a switch on the theatre switchboard. When current is turned on the coils become hot, their resistance being such that they become strongly heated but do not burn out. Cold air enters from a tunnel in the bottom of the box and goes up in glazed earthenware pipes, 12 inches in diameter, in different parts of the theatre. The cold air main tunnel is 20 inches in diameter. In the sketch herewith the brick pit is shown at *a*, the slate frame at *b*, the iron wire coils at *c*, while *d* represents the cold air pipe and *e* the pipes through which the heated air ascends to the auditorium of the theatre.

Rapid Transit in New York.

A great deal of information about "Rapid Transit in New York" has appeared in the daily press, but the first presentation of exactly what it means and how it will be carried out, and how the tunnel and its stations will actually appear, is contributed to *Scribner's Magazine*, for May, by William Barclay Parsons, chief engineer of the Rapid Transit Commission. The illustrations, drawn under Mr. Parsons's supervision, show precisely what this great engineering work will be like. The paper is an authoritative account of the whole project.

The Shelbyville, Ind., Electric Railway, Heat, Light and Power Company, which recently received a franchise from the city, has been granted a franchise along the Michigan road from the Decatur County line to the Marion County line. It is the intention to connect the line with one extending from Madison, Ind., *via* Osgood, Greensburg, Indianapolis, etc., to Toledo, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

COMPLETE PROGRAMME OF THE CHICAGO CONVENTION.

Unusual interest is being manifested by central station managers throughout the country in the meeting of the National Electric Light Association, to be held at Chicago, May 22, 23, 24. The indications are that there will be a very large attendance of electric lighting men. The programme has been made up in accordance with suggestions from central station managers as to their needs, and a glance will show that the themes treated are in the hands of men that thoroughly understand their subjects. The papers to be read are the following:

"Uniform Accounting," by Lieutenant James Blake Cahoon, Syracuse, N. Y.; "Equitable, Uniform and Competitive Rates," Henry L. Doherty, St. Paul, Minn.; "Central Station Economics," W. L. Abbott, Chicago, Ill.; "Series Alternating Enclosed Arc Lamps," William Lispenard Robb, Hartford, Ct.; "Alternating Current Generators," H. G. Reist, Schenectady, N. Y.; "Exhaust Steam Heating," Colonel F. A. Copeland, La Crosse, Wis., and Harry J. Frith, Watseka, Ill.; "Combination Electric Lighting, Power and Railway Work," R. S. Feicht, Pittsburgh, Pa.; "Automobiles as a Source of Revenue to Central Stations," Elmer A. Sperry, Cleveland, Ohio. The topic, "Free Wiring," will be introduced and discussed by Chas. R. Huntley, of Buffalo, N. Y.; E. L. Bemiss, of New Orleans, La., and Dudley Ferrand, of Newark, N. J.

The question of municipal ownership of electric lighting plants will be discussed and a report will be made regarding the progress of the investigation of municipal plants, and plans formulated for the continuance of this work.

The following gentlemen form the local reception and entertainment committee:

Louis A. Ferguson, chairman; B. J. Arnold, C. E. Brown, F. E. Donahue, H. R. Hixson, A. O. Kuehmsted, C. A. Munson, J. B. Wallace, F. B. Badt, F. H. Clark, Edward B. Ellicott, Samuel Insull, W. W. Low, Julian Roe, G. S. Whyte, George C. Bailey, Norman Collins, C. E. Gregory, E. B. Kettle, A. D. Lundy, Thomas I. Stacey, J. R. Wiley, Charles T. Boynton, C. D. Crandall, Arthur Hartwell, F. W. Kohler, G. A. McKinlock, B. E. Sunny and James Wolf.

This committee has arranged for a general reception at the Auditorium Parlors on Monday evening, May 21; for an automobile ride for the ladies on Tuesday morning with luncheon at the Washington Park Club; on Wednesday, a shopping tour in the morning and a matinee in the afternoon; on Thursday, the Art Institute and Public Library will be visited in the morning and a matinee in the afternoon.

The Auditorium Hotel has been selected as convention headquarters, and delegates will be allowed special rates.

The Trunk Line Association, the Central Passenger Association, the Southeastern Passenger Association and the New England Passenger Association have granted a special rate of a fare and one-third, on the certificate plan, for the round trip, from all points in their territory, for delegates and friends attending the convention. This rate is good for three days (not including Sundays) preceding and the three days following the adjournment of the convention.

When purchasing your ticket, ask the agent for a certificate showing that you have paid full fare going, and this certificate, when properly *vised* at the office of the secretary of the association, will enable you to buy your return ticket at one-third the regular rate.

A special train for the eastern delegates will be run over the Pennsylvania Railroad, details regarding which can be had by application at the office of the association, 136 Liberty street, New York.

The present officers of the association are: S. T. Carnes, president, Memphis, Tenn.; Oscar T. Crosby, first vice-president, Washington, D. C.; J. B. Cahoon, second vice-president, Elmira, N. Y.; Geo. F. Porter, secretary and treasurer, New York; C. O. Baker, Jr., master of transportation, New York; F. A. Copeland, W. Worth Bean, W. McLea Walbank, Samuel Insull, Samuel Scovil, H. M. Atkinson, E. F. Peck, William Brock and Chas. E. Scott, executive committee.

National Association of Manufacturers.

The fifth annual convention of the National Association of Manufacturers held in Boston last week was in every way successful. The officers were reelected as follows: President, Theodore C. Search, of Philadelphia; secretary, E. P. Wilson, of Cincinnati; treasurer, Charles A. Schieren, of New York; general manager, Edward H. Sanborn, of Philadelphia. The banquet was an especially brilliant affair. Speeches were made by the Chinese Minister, Wu Ting-Fang, Hon. Lyman J. Gage, Secretary of the Treasury; Hon. Elihu Root, Secretary of War; Hon. John D. Long, Secretary of the Navy; Hon. Timothy L. Woodruff, and others. Hon. Roger Walcott, ex-Governor of Massachusetts, presided. The next meeting will be held in the city of Detroit.

ELECTRIC RAILWAYS

The Marlboro, Mass., Street Railway, which consists of the Marlboro & Hudson and the Framingham, Southboro & Marlboro Street Railways, has been sold to James F. Shaw & Company, who have had an option on the road for several months.

By the time the American Street Railway Association meets in Kansas City next October many changes will have been made in the street railways of that city. On account of its steep grades, Kansas City was for a long time considered as the stronghold of the cable system. By the construction of a viaduct and the use of the present tunnel, however, the only remaining cable road will be changed over to an electric system. It is stated on good authority that the street railway company intends to spend over $1,000,000 during 1900 on improvements and extensions.

The Minneapolis General Electric Company has made plans for increasing its power plant on the east bank of the river to the extent of about 900 horse-power, or about 20 per cent of its present capacity. New and additional water wheels will be installed, and to lead the water from them the old McMullan tunnel will be enlarged. The old tunnel was about 10 feet wide by 12 or 14 feet high. The new tunnel will be 16 feet wide and 20 feet high. Its entire length will be about 320 feet. The new tunnel will follow the old one to within perhaps 50 feet of its upper end, where it will be turned to the east, while the old tunnel inclined to the west. The tunnel will be 45 feet below the surface of the river above the falls, and the entire length will be excavated through the white sand rock which lies below the blue limestone. The stone is so soft that borings will be made with ship augers, and the rock will then be loosened with dynamite. The tunnel walls will be lined with stone masonry two feet thick.

A Letter from Professor Elihu Thomson.

TO THE EDITOR OF ELECTRICAL REVIEW:

In giving consent to a telegraphed request for the use of my name in connection with the "Dr. Pupin for President" circular, I feel that it is but just to say that while I favored Dr. Pupin as an independent nominee, I would have withheld my consent had all the circumstances of the case been known to me.

ELIHU THOMSON.

Lynn, Mass., April 28.

A New System of Multiple Unit Control.

Under the auspices of the Boston Elevated Railway Company, which controls the street railway system of Boston, Mass., experiments have been made recently in the subway in that city with trains of electric cars operated from the third rail, the experiments being conducted late at night after the ordinary passenger traffic ceases.

The illustration herewith shows a train of two cars on the Westinghouse system, which is one of the various electric methods of control now undergoing test. The train embraces a combination of electrical and compressed air devices of great interest. In one end of each car is a strong steel compartment in which are placed all of the control mechanism. The floor and framing in the front end of the car over the motor truck are also of steel, this metallic construction being adopted to minimize the danger of fire.

A Two-Car Train Equipped with a New System of Multiple Unit Control.

The train in service at the Boston tests consists of four cars. These cars carry two 150 horse-power motors each, one motor being mounted on each truck. It is calculated that a speed of 44 miles an hour will be maintained upon a level by the train. On this train the electric apparatus is controlled by compressed air, which is also used for braking. The train may be operated by one man from the motorman's compartment at either end of it or may be broken up into parts, even into its individual cars if desired, each unit being self-contained, yet all operating together when proper connections between them are made.

The electric pneumatic system of train control employs a standard controller, to which are attached compressed air cylinders fitted with pistons and suitable operating gearing for moving the controllers step by step, in starting and running the train, and to return the controllers to the "off" position. Similar cylinders, also operated by compressed air, reverse the controllers, so that the train may be moved at will in either direction. Still other cylinders come into play in emergencies to open the circuit breakers, and to restore them after being opened.

The air valves for the various cylinders are operated by electromagnets, energized by an electric current of low voltage from a storage battery. The introduction of this low voltage current is another important feature of this system. The use of low voltage greatly reduces dangerous grounds and short circuits, as the system is entirely independent of, and isolated from, the main power circuit. With the high voltage system fuses are required in the car circuits, which are a constant source of annoyance and delay. With the low voltage system no fuses are required.

Both the compressed air and the current used in the control of the system are stored upon the cars, and the operation of this controller is independent of interruptions in the main power current or wide variations in its voltage. As both reservoir and battery are charged while the car is in service, no inconvenience or labor is involved in keeping them charged.

A great advantage that is claimed for the system is the combination of simple and well tried devices. The controller and circuit breakers are standard apparatus, while the air brake and controlling system is completely interconnected so that whenever the brake is applied either by design or accident (due to the breaking apart of the train), the controllers are at once brought to the "off" position.

A single handle is employed to perform all the operations of both controller and circuit-breaker. This handle automatically returns to the "off" position when the motorman removes his hand. All parts are readily accessible for inspection and repairs. To inspect and repair the system, therefore, is largely the work of an ordinary mechanic with his usual appliances, rather than a series of tests and measurements by an expert electrician. Another novel point is the synchronous movement of controllers. In this system the electrical impulse which acts upon the several valves, causing each successive step of the controllers, is produced by the switch in the hands of the motorman at the front end of the train. This gives reliable synchronous movement of all controllers.

The simplicity of the system is striking. The piping for compressed air, and the wiring for the electric current are reduced to a minimum. The electro-pneumatic control is applicable to any number of motor cars in a train, and its advantages become even more apparent as the number of motor cars in a train is increased. By the movement of a lever, the power is applied, or is cut off from all the motors of the train simultaneously.

Exactly the same general system which is now proposed for train control has been in use for years in connection with the automatic control of interlocking switches and signals; and in this field the competition which existed at the outset between electric control and compressed-air control has resulted in the general adoption of the electro-pneumatic system to the exclusion of the electric system of control. Certainly the control of the electric motors on elevated trains is no more exacting than the control of air brakes, or the control of the complicated switches and signals in such places as the Broad street station of Philadelphia, or the new Boston terminal station.

April 18 witnessed the first public trial of the three systems of control offered to the Boston Elevated Railway. Among the hundred or so New Yorkers who attended the trial was President Rossiter, of the Brooklyn Rapid Transit; Vice-President Skitt, of the Manhattan Railway Company, and from the same company L. B. Stillwell, consulting engineer; General Superintendent Baker, and Messrs. Pegram and Gould; President Vreeland, of the Metropolitan, and Mr. Baldwin, of the Long Island Railroad. At three o'clock in the morning all the visitors assembled at Scollay Square station for an informal supper which was presided over by General Bancroft, of the Boston Elevated Company.

"Bubbling" in Washington.

Automobiling is all the go in Washington, D. C., where the universal asphalt system affords unrivaled opportunities. Many senators, representatives and government officials have become autofans, and will carry their craze back with them to their districts all over the country.

General Electric Company's Annual Report.

(*Concluded from page 423.*)

THIRD VICE-PRESIDENT'S REPORT.

SCHENECTADY, N. Y., April 10, 1900.

C. A. COFFIN, Esq.,
President General Electric Company.

SIR: I submit the following report on manufacturing and engineering for the fiscal year ending January 31, 1900:

The usual practice of billing the output of the works to the General Office at estimated factory cost has been continued. This cost includes all material and labor plus a percentage to cover all items of general manufacturing expense and engineering, and an ample allowance for depreciation. The percentages thus added to material and labor have been demonstrated by the annual inventory to be sufficient, as will be seen by reference to the financial statistics given in the report of the Second Vice-President.

The great increase in our orders has strained our factory facilities to the utmost notwithstanding the liberal additions heretofore made to our machinery and buildings. We were fortunate in having completed and equipped, at the Schenectady Works, the large machine shop mentioned in my last report. This shop is now crowded with work.

There have been erected at the Schenectady Works during the past year a forge shop of 16,000 sq. ft. and a storage building of 12,000 sq. ft.

Additions aggregating about 55,000 sq. ft. have also been made to the drafting room, pattern shop, punch-press shop and brass foundry, all substantial buildings of brick and iron construction.

The large iron foundry which was completed about a year ago has been found inadequate, and an extension of about 40,000 sq. ft. is now under way.

An extension to building No. 23, of about 40,000 sq. ft., has been started. This is needed to take care of the increased demand for switchboards, controllers, and similar apparatus.

At the Lynn Works we have completed a further extension to our steel foundry, of about 18,000 sq. ft. Also the new building for the manufacture of meters and instruments, mentioned in my last report, is now so crowded that a further increase of 7,000 sq. ft. has been found necessary and is now under way.

We have purchased 14 acres of land at the River Works, at Lynn, in order to give room for future extensions.

At the Harrison Works the large fireproof building, mentioned in my last report, has been completed and is in full operation, and further extensions are under consideration in order to give the needed increase in our output.

The total area of the factory buildings aggregates approximately 2,000,000 sq. ft., which will be increased 100,000 sq. ft. when the buildings now under way are completed.

The number of employés in all the works is about 12,000.

We expended during the past year for new buildings, extensions and machinery equipment, a total of about $900,000, exclusive of the expenditures for patterns, special tools, furniture, etc.

The engineering work during the past year has been chiefly in the direction of improved efficiency and overload capacity, and in the design of larger sizes of apparatus of existing types.

A number of the great electric generators (5,000 H.-P.) for the new station of the Metropolitan Traction Co., of New York, have been in operation for several months and are regularly supplying current for the operation of electric street cars and for lighting, in the City of New York. We are now manufacturing eight machines of the same general character, which will be installed in the new station of the New York Gas, Electric Light, Heat and Power Co., of New York City, and used for the generation of current for lighting and power purposes, aside from electric street railways.

There has been a marked increase in the size of electric generators, of the direct-current type, suitable for lighting and power for moderate distances.

Long-distance transmission plants have increased in number and importance during the past year.

The revolving field type of alternating generator with stationary armature winding permitting the direct generation of electricity at high potentials, a form exclusively introduced by us, has met with great success and is now generally employed to the exclusion of older and less perfect types. Our orders during the year for this type of generator alone amounted to over 200,000 horse-power.

We have sold during the year about 150,000 H.-P. of large transformers of the air-blast type, a design introduced and supplied solely by us.

The United States Navy has generally adopted electricity in place of steam or hydraulic machinery for pumping, hoisting, ventilating, and operation of turrets, as well as for lighting and small power work.

There has been a continued increase in the number of electric motors used for driving machine tools in factories, and in such special applications as the operation of printing presses, ventilating, pumping, mining, cotton mill and paper mill machinery.

We have filled many important orders, covering all classes of our apparatus, for use in foreign countries.

There has been a marked increase in the demand for electrical apparatus of special design, which is more expensive than standard, takes longer to produce and diminishes the effective output of our works. To meet this demand we are systematically increasing our line of standard sizes, which can be produced of superior quality in shorter time and sold at a lower price.

There has been a continued improvement in the efficiency and quality of our numerous small articles of manufacture, such as arc lamps, transformers, and, particularly, switchboards.

We have continued to protect our new and important engineering designs, as far as possible, by applications for Letters Patent.

The work of our Factory Managers and Engineers is worthy of the highest commendation.

Respectfully submitted,

E. W. RICE, JR,
Third Vice-President.

SECOND VICE-PRESIDENT'S REPORT.

SCHENECTADY, N. Y., April 10, 1900.

C. A. COFFIN, Esq.,
President General Electric Company.

SIR: The Balance Sheet and Statement of Profit and Loss, herewith transmitted—with explanation of every item on the Balance Sheet—include the assets and liabilities and profit and loss accounts of the Edison General Electric, Edison Electric Light, and Thomson-Houston Electric Companies (which, for convenience of bookkeeping, are consolidated with those of the General Electric Company) at January 31, 1900; and when "the Company" is spoken of, all the above mentioned corporations are included.

ASSETS.

PATENTS, FRANCHISES AND GOOD-WILL.

These were carried in the last Annual Report at		$4,000,000 00
During the year there were expended for acquiring new patents, in patent expenses and patent litigation	353,333 87	
Total patent account before closing the books		$4,353,333 87
By vote of the Directors there was charged to Profit and Loss, as of January 31, 1900, one-half the then book value of patents, viz.	$2,000,000 00	
and all patent expenses of the year	353,333 87	2,353,333 87
Leaving all the patents, franchises, good-will, etc., of the Company standing on its books at the date of this report, as per Balance Sheet, at		$2,000,000 00

FACTORY PLANTS.

This account represents the Real Estate (lands and buildings); Machinery (steam plants, tools, appliances, etc.); Patterns (including drawings, etc.); and Sundries (fittings and other small property accounts) of the manufacturing plants at Schenectady, New York; Lynn, Massachusetts; and Harrison, New Jersey.

All are free from mortgage or other lien.

The lands of all three plants now amount to about 174 acres, and the total factory floor space of all their buildings is approximately 2,000,000 square feet.

It is worthy of note that the entire book value ($1,858,044.65) of all lands and buildings is less than one dollar per square foot of the total manufacturing floor space in those buildings.

The Company's constantly growing business has necessitated continuous expenditures to increase its manufacturing capacity by acquiring more land, enlarging old and erecting new buildings, and for general improvements and new machinery. The cost of these additions has been charged against the general earnings of the Company, as have also all expenditures for the maintenance and repair of buildings and machinery, plus an allowance to provide for depreciation.

On January 31, 1893, the book value of all three factory plants was		$3,958,528 21
In the fiscal years 1893 to 1899—both inclusive—additions of lands, buildings, machinery, etc., have been made at a total cost of		4,560,863 09
		$8,519,391 30
During those seven years there have been written off to provide for depreciation on these plants.		5,119,389 30
Leaving their book value at January 31, 1900.		$3,400,002 00
Divided as follows:		
Schenectady plant.	$2,300,000 90	
Lynn plant	900,000 80	
Harrison plant (Lamp Factory)	200,000 30	$3,400,002 00

A summary of the changes in this account since the last Annual Report is as follows:

	Book Value Jan. 31, 1899.	Cost of additions during the year.	Written off at the end of the year.	Book Value Jan. 31, 1900.
Real Estate	$1,857,044 65	$ 390,327 12	$ 389,327 12	$1,858,044 65
Machinery	1,542,955 35	650,633 00	651,633 00	1,541,955 35
Patterns	1 00	161,157 42	161,157 42	1 00
Sundries*	1 00	128,310 86	128,310 86	1 00
Totals	$3,400,002 00	$1,330,428 40	$1,330,428 40	$3,400,002 00

* Include office furniture and fixtures (of the Factories), horses and trucks, shop fixtures, benches, steam fitting (above ground) for heating system, sprinkler system for fire protection, electric wiring of buildings, etc., etc.

REAL ESTATE.

(Other Than Factory Plants.)

This account represents the investment in the Edison Building, 44 Broad Street, New York City; also a four-story brick building covering five lots on the corner of Avenue B and 17th Street, New York City; and sundry parcels of land in various places, mostly improved and rented, which have been acquired at various times, chiefly in payment of debts.

All are free from mortgages and will be sold when opportunities offer.

This account has decreased $51,391.28 during the year, chiefly by selling real estate in Atlanta, Ga., and Rock Island, Ill.

STOCKS AND BONDS.

Pursuant to the established policy of selling

securities which there is no special reason for holding permanently, various stocks and bonds have been sold for cash since the last Annual Report.

Their total par value was $2,755.518.05.

They were sold for..... ....$2,678,409 03
They had been carried on the books at..... 1,839,551 30

Profit $838,857 73

The money realized from the above sale of assets was expended upon extensions to the Factory Plants, in purchasing $400,000 of the Company's own Debentures and to protect and improve existing investments by acquiring (at a cost of $1,274,428) miscellaneous Stocks and Bonds, of the aggregate par value of $1,693,400.

In the book valuations of Stocks and Bonds remaining on hand since January 31, 1897, no material changes have been made since they were appraised three years ago. The book value of those not readily salable was then fixed, after careful examination of their worth at that time. Those having a market value are still carried under the price of then reported sales.

Those more recently acquired are carried at cost.

Schedules A and B annexed hereto contain lists of the most important of the Company's holdings of stocks and bonds. Their total par value is $11,466,309. They are carried at an aggregate book value of.....$5,754,748 03

In addition, the Company owns various other securities. As their present value is doubtful and their future value speculative, they are not set forth in the schedules. They are carried on the books as follows:

Stocks and bonds of Local Lighting and Street Railway Companies wholly owned (Par value $151,500)	41,852 00
Sundry holdings (Par value $418,-832).	335,547 01
Miscellaneous securities of many underlying, manufacturing, selling and patent owning corporations, and also of street railway and lighting companies, carried at one dollar for each lot, in all	121 00
Total book value of all stocks and bonds, as per Balance Sheet.....	$6,132,268 04

I believe the actual present aggregate realizable value of the foregoing described securities is fully equal to the total amount at which they stand on the books.

NOTES AND ACCOUNTS RECEIVABLE.

This account represents the total debts now due the Company.

They appear in the annexed Balance Sheet at an estimated realizable value—*i. e.* from their face, $7,314,930.12 (which is less than the billed amount of goods shipped during the last ninety days of the year), has been deducted an allowance of $337,119.82 for possible losses (see page 17).

I believe this allowance to be a fair one and ample under existing general conditions of business in the country.

SALES AND COLLECTIONS DURING THE YEAR.

The net amount of sales billed to customers during the year exceeded twenty-two million dollars—those of the last three months aggregating nearly seven million five hundred thousand dollars.

Of some 11,800 regular customers on the accounts-receivable ledgers, there were debit balances against 4,600 at the close of the fiscal year.

	Notes Receivable.	Accounts Receivable.	Total Face Values.
Total face value, Jan. 31, 1899 ...	$1,493,630 99	$4,313,330 76	$5,806,961 75
Of which there have been settled during the past year.....	1,149,275 88	4,031,227 77	5,180,503 65
Leaving unmatured or unsettled—originating *prior* to the current year—51 note accounts and 34 open accounts,	$344,355 11	$282,102 99	$626,458 10
The unmatured and unsettled balances of the current year are.....	$633,711 57	$6,054,760 45	$6,688,472 02
Total face value, Jan. 31, 1900 (see page 17)..	$978,066 68	$6,336,863 44	$7,314,930 12

"DOLLAR" NOTES AND ACCOUNTS.

In addition to the above there are old notes and accounts receivable of one hundred and ninety-two debtors, aggregating $1,272,665.95, which have been written off to Profit and Loss, except the nominal book value of one dollar for each debtor. They stand on the books at a total of $192, and are being liquidated gradually. The total amount realized from this class of notes and accounts by settlements made during the past year was $7,457.46.

ALLOWANCES FOR POSSIBLE LOSSES.

	Notes Receivable.	Accounts Receivable.	Total.
On debts existing at Jan. 31, 1899, there was then allowed	$298,130 00	$422,282 98	$720,412 98
Amount of such allowance absorbed during the current year in effecting settlements.....	248,169 76	368,558 17	616,727 98
Balance of allowance still standing on the old debts.....	$49,960 24	$53,724 76	$103,685 00
Above allowance is now increased		68,590 52	68,590 52
Total allowance on old debts.....	$49,960	24$122,315 28	$172,275 52
Allowance for possible losses on unmatured and unsettled balances of the *current* year.....	22,231 07	142,613 23	164,844 30
Total present allowance for possible losses.....	$72,191 31	$264,928 51	$337,119 82
Total face value (see page 16) ...	978,066 68	6,336,863 44	7,314,930 12
			$6,977,810 30
Add book value of "Dollar" Notes and Accounts...			192 00
Total book value as per Balance Sheet	$905,875 37	$6,071,934 93	$6,978,002 30

In the settlements of old debts, on which there were allowances for losses as above shown, there were realized $185,297.72 over last year's book valuations, less $39,968.82 loss in settling some debts below their appraised value. Net gain above appraised value, $145,328.90.

WORK IN PROGRESS.

This account does not include outlays for anything in process of manufacture at the factories, but represents expenditures for labor, material, etc., at cost, on 560 uncompleted installations of finished apparatus in progress at various places.....$1,024,552.60

Less partial payments thereon, received under the terms of the contracts as work progressed..... 150,424 24

Balance as per Balance Sheet .. $874,128 36

None of the estimated profit to be derived from these installations is included in the earnings of the year.

INVENTORIES.

These accounts represent actual inventories—counted and valued item by item—of raw materials and goods manufactured and in process of manufacture at the factories; of shipments in transit to storerooms of local offices; of manufactured goods in storerooms of local offices; of materials in local repair shops; and also of all goods on consignment.

Raw materials have been valued at the lowest price paid by the Company during the last three months of the fiscal year. The market price prevailing on January 31, 1900, was used where it was lower than the lowest price paid by the Company during the said three months.

Active-selling finished and partly finished apparatus and supplies were valued at estimated factory cost; inactive or slow-selling apparatus and supplies at about 50% of estimated factory cost; and obsolete apparatus and supplies at scrap value.

FACTORIES.

On the above basis, the inventories of the factories exceeded their book value. Following the practice of previous years, the whole of such excess has not been taken as a profit, but a portion has been retained as a reserve against possible increased cost of manufacturing, in case of further advance in prices of raw material.

The very large increase over last year's total factory inventories is due to accumulation of work—owing to the unfilled orders in process at January 31, 1900, being $3,000,000 more than those at January 31, 1899—as well as to the increased value of the raw materials included in these inventories.

GENERAL AND LOCAL OFFICES.

During any fiscal year, goods are taken in and out of local office inventories at the estimated factory cost then prevailing. Consequently, at the close of that fiscal year, there must always be considerable change in book values of finished apparatus and supplies carried over, to adjust their inventory prices to latest estimated factory costs and to provide for losses due to returned articles, cost of repairs, breakages, boxing, reclassifying and writing down the book value of goods no longer quick selling, etc., etc.

Owing to present increased estimated factory cost, the inventories of apparatus and supplies in all local offices showed an increase over book value of $33,286.04, which amount has not been treated as a profit, but is held as a reserve.

OFFICE FURNITURE AND FIXTURES.

The total inventoried value of all office furniture and fixtures, machinery, tools, in-truments, etc., in the general and local offices and in local repair shops, was $78,921.99. All these items have been reduced to a total book value of one dollar and the difference charged to this year's Profit and Loss.

CONSIGNMENTS.

Finished apparatus for novel uses has been delivered to various concerns, subject to purchase if its operation is successful. The greater part of consignment account represents such contingent sales, and the remainder represents apparatus on exhibition or loaned to regular customers for temporary use by them.

All such shipments are charged to this account at estimated factory cost.

Their total is $69,988 96
Less allowance for depreciation..... 24,654 11
Net book value of consignments as per Balance Sheet. $45,334 85

LIABILITIES.

The Company has no Note Payable, nor is there under discount any paper bearing the Company's endorsement or guaranty.

It has not borrowed any money, nor has the Company's credit been used during the year either by issuing notes, endorsing customers' paper for discount or lending its name in any way; but by adhering to its established policy of maintaining sales on a basis of cash or short credit to desirable customers, all purchases have been paid for in cash.

DEBENTURES.

During the year the Company has purchased and canceled $400,000 of its own 5% Gold Coupon Debentures due June 1, 1922, at an average cost of 117.68 per cent.

ACCOUNTS PAYABLE.

This account includes all unpaid audited indebtedness.

At the close of business on January 31, 1900, the unpaid vouchers on hand—none of which was then due under the terms of purchase—amounted to..... $317,020 03
Between January 31 and February 26, 1900, the date of closing the general books, additional liabilities belonging to the past year were audited, amounting to..... 686,344 02

Total as per Balance Sheet $1,003,364 05

The amount of unpaid vouchers carried over in this way monthly—by keeping the books, other than the cash book, open a sufficient time to include each month's obligations in that particular month—has averaged during the year about $860,000

ACCRUED INTEREST ON DEBENTURES.

This account, as its name implies, is the full amount of 5% interest accrued to January 31, 1900, on the Company's $5,300,000 outstanding Debentures.

UNCLAIMED DIVIDENDS.

This account represents the full amount unpaid on all dividends declared and payable to January 31, 1900, inclusive—the addresses of a few stockholders being unknown.

Respectfully submitted,

J. P. ORD,
Second Vice-President.

We observed the instructions given and the precautions taken to enter all accounts payable on the books at the time of closing and are satisfied that all known existing current liabilities of the Company are included in the balance sheet.

The policy of the Company as reflected in its accounts is to charge off all ascertained shrinkages or losses immediately and at the end of each year to make liberal allowance for possible losses; but no profits are written until sales are made.

We have read the report of the Second Vice-President and find that it correctly explains each item of the Balance Sheet and sets forth in exact terms the general accounting methods of the Company.

PATTERSON, CORWIN & PATTERSON,
Certified Public Accountants.

CONSOLIDATED BALANCE SHEET OF JANUARY 31, 1900.

ASSETS.			LIABILITIES.		
Patents, Franchises and Good-Will		$2,000,000 00	Capital Stock:		
Factory Plants		3,400,002 00	7 per cent Cumulative Preferred	$2,551,200 00	
Real Estate (other than factory plants)	$ 563 643 44		Common	18,276,000 00	$20,827,200 00
Stocks and Bonds	6,132,268 04	6,695,911 48			
Cash		1,537,071 86	5 per cent Gold Coupon Debentures		5,300,000 00
Notes and Accounts Receivable	6,978,002 30		Accounts Payable	1,003,364 05	
Work in Progress	874,128 36		Accrued Interest on Debentures	44,166 67	
	7,852,130 66		Unclaimed Dividends	4,935 85	1,052,466 57
Inventories:					
Factories	$7,264,666 01				
General and Local Offices	737,580 23				
Consignments	45,334 85	8,047,581 09			
		15,899,711 75	Profit and Loss		2,353,030 52
		$29,532,697 09			$29,532,697 09

CONSOLIDATED PROFIT AND LOSS ACCOUNT OF JANUARY 31, 1900.

EXPENSES.			EARNINGS		
Cost of Goods sold	$16,436,935 19		Balance January 31, 1899 (Surplus)		$ 156,570 99
General Expenses, Taxes, Depreciations, Losses and Allowances for Losses	2,136,668 38		Sales	$22,379,463 75	
Patents and Patent Expenses	353,333 87	$18,926,937 44	Royalties and Sundry Profits	868,706 70	23,248,170 45
Interest on Debentures*		281,666 67	Dividends and Interest received on Stocks and Bonds owned	309,428 23	
Dividends Paid:			Interest and Discount	80,322 06	389,750 29
On Preferred Stock—7 per cent for the year	178,584 00				
On Common Stock—three dividends of 1½ per cent each: paid July 15, '99, Oct. 14, '99, and Jan. 15, 1900	822,420 00	1,001,004 00			
Patents and Good-Will written off		2,000,000 00	Profit on sales of Stocks and Bonds	838,857 73	
Balance January 31, 1900 (Surplus)		2,353,030 52	Less Premiums paid for Debentures purchased and canceled	70,710 83	768,146 90
		$24,562,638 63			$24,562,638 63

* On $5,700,000 for ten months and on $5,300,000 for two months.

E. & O. E. J. P. ORD, *Second Vice-President.*

Independent Telephone Association.

The Independent Telephone Association of the United States will hold its annual meeting in Cleveland, June 12, 13 and 14. Judge Thomas, of Chillicothe, Ohio, is president of the association. The meeting promises to be an unusually large one and will be attended by representatives of some 3,000 independent telephone exchanges.

ITEMS OF INTEREST.

The engagement of Mr. William W. Ames, of the Brooklyn Equipment Company, to Miss Minnie West, of Montclair, N. J., has been announced. The host of friends possessed by Mr. Ames in electrical circles will all extend congratulations.

Mr. F. S. Pusey, president of the General Electric Automobile Company, made the trip recently from Philadelphia to the Windsor Hotel in Atlantic City in an electric automobile with one set of batteries and on but one charge of the same. The special point claimed for this run of 60 miles is that a regular commercial battery made for practical every day service was used instead of a "short-lived" battery made for unusually long or special run.

The Connecticut Lighting and Power Company's offer to the city of South Norwalk, Ct., of $90,000 for its electric lighting plant will be refused. The plant, as it stands to-day, has cost the city of South Norwalk, approximately, $60,000; it is paying at the present moment at the rate of four per cent interest on $120,000.

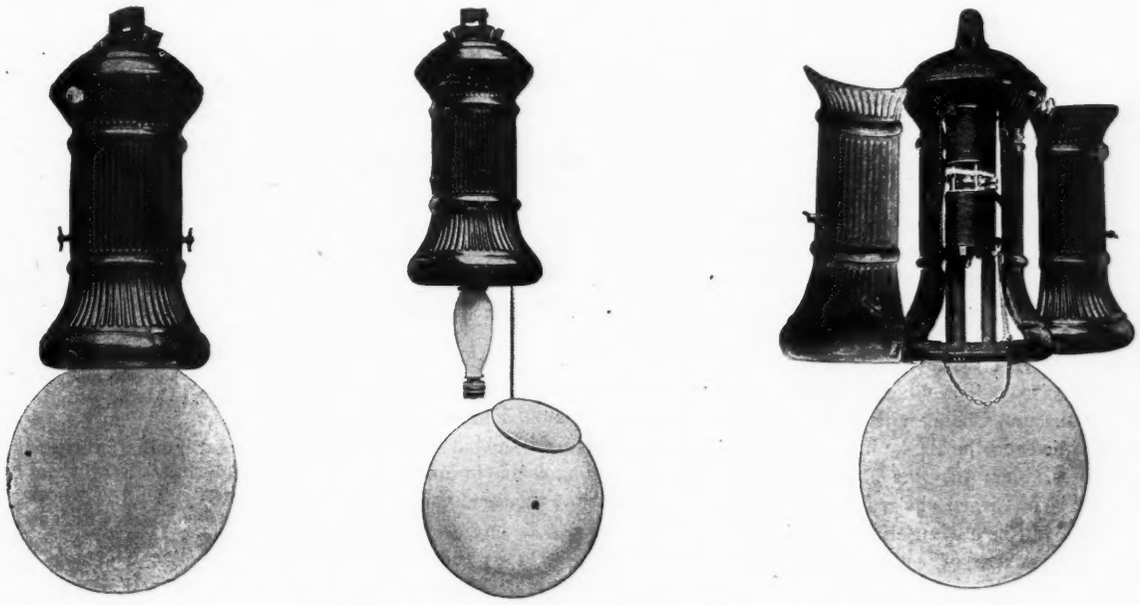
A company has been incorporated in Denver to furnish electric power for Leadville, Colo. The company is headed by several wealthy mine owners, including John F. Cambion, Seeley W. Mudd, William Byrd Page and Charles Baettcher, who propose to establish an immense water-power electrical generating station on Eagle River, 23 miles from Leadville. The present plans contemplate four three-phase units of 1,000 kilowatts each and the full capacity has already been contracted for. The advance in the price of coal in Leadville has made some change necessary and hastened the carrying out of the electric project, which has been in contemplation for several months. Land and water rights are secured at the power station. The water will have a fall of 750 feet, if desired.

An agreement has been executed between the Ontario Power Company, of Niagara Falls, and the commissioners of the Victoria Niagara Falls Park. Two years will probably be required for putting in the plant, and at the end of that time the company will be in a position to transmit power to Toronto, Hamilton and other points of demand. The power company paid $30,000, representing two years' rental, in advance. The company will begin an initial development of 30,000 to 60,000 horse-power at an expenditure of $2,000,000. This development can be readily increased to meet the demand for power to 300,000 horse-power. Negotiations are already in progress with many electrical industries, and the erection of the steel plant required for the transmission of power will at once be begun. Toronto and Hamilton will require at the outside 10,000 to 15,000 horse-power. Everything will be completed, so the company say, within two years.

A Novel Type of Arc Lamp Casing.

The modern enclosed arc lamp is an exceedingly refined product and an infinite degree of ingenuity has been expended in bringing it to its present great perfection. Even in the less prominent portions of the design there is an opportunity for much skill in the planning, as is well illustrated in the engravings of a new type of arc lamp shown herewith.

The casing of this lamp is constructed of embossed metal, the embossing running in two directions. The flanges at top and bottom and the beadings running round are crossed by the vertical flutings which are a feature introduced both for aesthetic reasons and to stiffen the case. The shape of the stamping makes the case much more rigid than usual, and the doors in it are so built that by opening them every part of the mechanism of the lamp is exposed and immediately accessible. The case is adapted to be used out of doors without the necessity of a hood or other weather protection, and the maker of the lamp, the Belden-Larwill Electric and Manufacturing Company, of Fort Wayne, Ind., claims that the lamp can be entirely disassembled without removing the case. It is made in either steel, brass or copper and to various finishes as desired.



FIGS. 1, 2 AND 3.—A NOVEL TYPE OF ARC LAMP CASING.

Illinois Electrical Association Formed.

At a meeting of owners of electric light plants held in Springfield, Ill., recently, a permanent state organization was effected. The association will be known as the Illinois Electrical Association. A constitution was adopted and the following officers were elected: President, J. D. Gorlach, Chester; vice-president, E. B. Hillman, Wyoming; secretary, H. E. Chubbuck, Quincy; treasurer, John Davis, Litchfield. The meeting was called for the purpose of discussing the project of organization in order to secure such legislation as would secure for those interested stability of contract. This was discussed at the meeting, and the question of municipal ownership was considered.

The annual meetings of the association will be held the second Tuesday in November. The next meeting will be held at Peoria.

American Bell Telephone Stock.

Stockholders of the American Bell Telephone Company have been notified by circular that in pursuance of the vote passed at the annual meeting a distribution of American Telephone and Telegraph Company stock would be made beginning on May 15. Distribution will be on the basis of two shares of American Telephone stock for one of Bell Telephone. Another circular from the American Telephone and Telegraph Company says the directors have voted to offer to stockholders new stock of that company for cash at par ($100 a share) in the proportion of one new share for every five shares of old stock. That "each stockholder of the Bell Company on depositing his certificates for examination and exchange becomes entitled to subscribe for such new stock in the above proportion. The company will neither buy nor sell rights."

Fatal Accidents at the Paris Exposition.

The first fatal accident at the Paris Exposition occurred April 28, when a reenforced concrete bridge crossing the Avenue de Suffren and connecting the exposition grounds proper with the "Celestial Globe," fell on a number of passersby in the street below. Accounts of the number killed vary from six to nine, with many injured.

The second fatal accident took place on April 30, when two workmen were killed by a collapsing scaffold.

BUSINESS NEWS.

The Hardy Lamp Company, of Pittsfield, Mass., is sending out a large amount of its "Hardy" lamps, which have proved very satisfactory to the market in general. This lamp can be made on any base and at any voltage from 45 to 125.

The Billings & Spencer Company, of Hartford, Ct., has been sending out an unusually large amount of orders on its drop-forged commutator bars. It maintains that this bar is true to gauge, and one of the best of its kind on the market. It also states that special and exhaustive tests have been made on the durability and strength of this bar, which tests have proved most satisfactory in every way.

We are in receipt of a very attractive calendar from the New York & Ohio Company, of Warren, Ohio. One of these calendars is sent out each month by the above company, containing an announcement of their well-known Packard incandescent lamps and transformers. The picture is a handsome reproduction of an oil painting, with a monthly calendar below. Each month the calendar contains a different picture. The card has a background of buff, and the name of company in gold letters.

The Central London Underground Electric Railway.

The new line of railway between Shepherd's Bush and the Bank, in London, known as the Central London Electric Railway, will be opened in June. It is practically completed, but a large amount of structural work has still to be done at the various stations. Already a number of trains have been run from time to time, to test the roadway and the engines and carriages. The new line will be of the greatest public service in getting to and from the city, the west-end and the western suburbs. It is another development of the method London has found so valuable in relieving the congested streets—that is, by burrowing underground, and carrying the traffic there. Of course, the metropolis is not the only large centre of population which has adopted the underground system. There is a service of tramcars beneath the surface in Boston; Glasgow has a subterranean tramway service, and in Budapest the electric cars pass along Andrassy avenue beneath the roadway, so as not to spoil the appearance of that fine thoroughfare. The latest line begins at Shepherd's Bush, and the stations are Holland Park, Notting-hill-gate, Queen's-road, Bayswater, Westbourne-grove, the Marble Arch, Davis-street (for Bond-street), Oxford-circus, Tottenham-court-road, British Museum, Chancery-lane, the General Post Office and the Bank; but the eastern terminus, when the line is fully completed, will be at Liverpool street. In time, also, there will be a connection with the line now in course of construction from Baker street to Waterloo.

The Central London Railway is seven miles long, and in some places goes to a depth of 100 feet. There are two tunnels of 11 feet six inches diameter for up and down trains. The system of construction is that invented by the late Mr. Greathead, and has been frequently described. It is an electric line. The driving of the tunnels presented no natural obstructions of a serious engineering nature, and by working with the Greathead shield there was no need to break up the streets. Probably few persons are aware, as they proceed along Oxford street to-day, says the London *Standard,* that it is undermined for a great part of its length, or that a railway is being actively constructed beneath their feet. A great deal of surface work has also been done at Shepherd's Bush, where the generating plant has been erected, and where there are repairing sheds, carriage sheds, machine shops, and the like. No more complete or well-designed generating station exists in this country, and Mr. Binnie deserves all the compliments which have been paid him, both in regard to the electrical installation and the line itself. The engine house is 200 feet by 86 feet 9 inches, and contains six Reynolds-Corliss compound condensing engines, of 1,300 horse-power each; six 850-kilowatt, three-phase generators, coupled direct to engines, with revolutions of 94 per minute, and a voltage of 5,000; six 50-kilowatt, direct-coupled exciter and lighting engines, and two eight inches by 12 inches by 15 inches duplex ram feed pumps. The boiler house is 148 feet by 87 feet, and contains 16 Babcock & Wilcox water-tube boilers, with Vicar's mechanical stokers, the heating surface being 3,580 square feet, working pressure, 150 pounds, and coal storage bunkers of 1,000 tons capacity. Hunt's coal conveyor is used, so that the fuel is taken from the railway wagon and automatically conveyed to the furnaces. There are also at Shepherd's Bush four sets of Green's economizers, four Barnard-Wheeler cooling towers, a carriage shed, 360 feet by 160 feet; carriage repairs shed, 360 feet by 80 feet; engine repairs shed, 180 feet by 80 feet; machine shop, 140 feet by 40 feet; a smithy, 40 feet by 40 feet, and a running shed, 140 feet by 80 feet.

The various engines are the best of their kind and have been furnished by the British Thomson-Houston Company (limited), who also have contracted for the distributing system and the locomotives. Many of the details of the machinery are of the greatest interest to engineers, but it will be sufficient here to say that everything that foresight can devise has been included, so as to make the running on the railway perfect. It is proposed to have a two and one-half minute service, and the train will consist of seven carriages, which will accommodate 336 passengers. The weight of a train will be 105 tons, exclusive of locomotive. There is only to be one class of car, though the original intention was to have first and second cars. These are on the American pattern, and are brilliantly lighted by electricity. The atmosphere on the line ought to be perfectly clear. As the trains in each tunnel will always run in one direction, they will act as pistons, and thus provide their own ventilation. Between each pair of adjacent stations the line will dip—that is, the stations are nearer the surface than the general part of the railway. The advantage is two-fold; it will reduce the height of lifts, and it will also place the stations, as it were, on a hill. Trains running into a platform will have their speed naturally checked, while the starting will be on a down grade, and, therefore, will make a less sudden demand for power on the central station.

There are staircases as well as lifts, provided at the stations. Of these, the most remarkable is the Bank station. It extends underneath the open space in front of the Mansion House, and already the public subway is provided just below the road pavement. This sweeps in a somewhat oval shape right round the whole of the space, and the passenger who uses it may regain the surface at points convenient to Cornhill, the Bank, Walbrook, the Royal Exchange, and one corridor communicates with the terminus on the City and Waterloo Railway. These subways are 15 feet wide, and as they are only just beneath the road surface, the staircases are short. They are lined with glazed tiles, and well lighted with electricity. Beneath the public subway is another of about equal section for pipes, sewers and electric light wires. Within the oval formed by the subway is the Bank station. Practically all the roadway in front of the Mansion House, which is called Mansion House street, is now a deck of steel and concrete, with paving overlaid, supported by pillars at frequent intervals. There will be five lifts to convey passengers to the platforms in the enlarged tunnels, 65 feet below the surface. The work at this station has been carried out without interference with the mass of traffic which passes the Bank every day.

The locomotives are electrical, and have been built in America. Their shape is rather unusual, but the design is excellent for this particular purpose. Each locomotive weighs about 42 tons, stands nine feet, four and one-half inches high, is 30 feet long, and has a total wheel base of 24 feet 4 inches. All the wheels, eight in number, are driving wheels, and the engines are bogey-fitted so as to take the curves of the line. The electricity is conveyed by a third rail, the return current passing through the ordinary rails. The third rail is of steel, weighing 80 pounds to the yard, and is supported on creosoted wood insulators. The track rails weigh 100 pounds to the yard, and are laid on horizontal sleepers. The locomotive picks up the electricity through a metal shoe running on the central rail. It is estimated there will be something approaching 100,000,000 passengers with the two-minute service. The line was designed by Sir Benjamin Baker, Mr. Binnie being the resident engineer. The effect of the line on the street traffic will be watched with great interest. It will be remembered that Sir J. Wolfe Barry estimated that about one and one-quarter million of people traveled daily out and in to London, and he computed that the time lost owing to the congestion of traffic in Cheapside, the Strand, Tottenham-court-road and Piccadilly is equivalent to the loss of £2,154,000 a year. The journey over the whole of the new line will take 25 minutes, while from Oxford-circus to the Bank the time will be 10 minutes. It has been found from observation that the average time of an omnibus from Shepherd's Bush to the Bank is an hour and one-quarter.

POOR INCANDESCENT LIGHTING—ITS CHIEF CAUSE AND REMEDY.

BY H. L. MONROE.

(*Concluded from page 422.*)

If the service is not properly fed with new lamps it is sure to languish and suffer. The only objection to be urged against the free renewal policy is the expense of it. The question is asked: "Can a station afford the expense?" That I can answer most positively "Yes," for all meter customers. The real question is not whether central stations can afford this policy, but whether they can afford to do without it. In these days of Welsbach burner competition, and the Kitson and other new forms of oil lamps with Welsbach burners, electric lighting companies certainly need to take some steps toward an effective improvement in their lighting. The lamp costs but a small fraction of the cost of the current to light it. The other expenses are from 10 to 12 times the cost of the lamp. It is certainly foolish to attempt to save on the one-tenth which the lamp costs, and thereby destroy the value of the remaining nine-tenths. How much better to expend the one-tenth by free renewals, and thereby secure the full value of the remaining nine-tenths. The actual cost of free renewals will average about one-half to two-thirds cent per kilowatt hour, and if stations wish to be reimbursed, they can increase their meter rates accordingly, or they adopt free renewals in place of any reductions in rates. There ought to be little difficulty in central stations obtaining slightly increased rates for the great improvement of service which the free renewals will secure. Aside from this, however, central stations can afford the step, whether they are to be reimbursed for it or not. In the first place, if free renewals make it possible to improve the lighting service fully 50 per cent, certainly two-thirds cent per kilowatt hour is a small price to pay for this improvement. Such improvement means increased business, customers better satisfied, absence of complaints and allowances and maintenance of better rates. No such slight expense should be spared, when it will make electric lighting so good that no one needing light can very well afford to be without it. I wish to urge upon central station management the importance of having an incandescent lamp department, which should be responsible for the superintendence of lamps and conditions of lighting service. Adopting free renewals, the central stations should make it their business to look after the lamps and conditions of lighting service. Experience has shown that they can not depend upon the customer to renew them properly even when they are furnished free. Besides, attention to this detail pleases the customer, and electric lighting is bound to be more popular when all a customer is required to do is to pay his bill and turn his switch, and the lighting results are always ready and invariably good without any further trouble on his part.

The best methods of looking after lamps are as follows:

1. Periodically remove all lamps from the circuits one to four times per year, according to the conditions, and replace them with new ones. Photometer the lamps removed and save those measuring above a prescribed limit (say 13 candle-power) for use at high voltage points, or locations where reduced candle-power is of slight importance. Scrap the remaining lamps.

2. Give a new lamp in exchange for an old one for, say, every $3.00 worth of current supplied, or for any fixed amount determined by the meter rates and conditions.

The second plan is an excellent one, in that it offers a bonus for the use of current and regulates renewals on the correct basis of number of hours of lamp service. It can be profitably adopted wherever meters are in use. A station attendant should visit customers quarterly and install the number of new lamps due each, removing and returning to the station an equal number of old lamps. If station attendance is limited, a lighting company can fill out and mail to its customers, each quarter year, blanks similar to the following:

> 19
>
> Due to Mr.....
>
> .....16-candle-power lamps for the quarter year ending..... .....
>
> which is on the basis of one lamp for every $3.00 worth of current supplied.
>
> Present this slip at the station or office.
>
> .....

Summing it up, therefore, we find that to have good lighting service, it is necessary, (1) that incandescent lamps be supplied by central stations free of charge to the customer, and, (2) that these lamps be periodically renewed so as to weed out the dim lamps and keep the service bright. That such a system pays most handsomely has been found to be the experience of every central station adopting it. It is the practice of the leading stations to-day, and it has done more than anything else to build up successfully the lighting business of the United States. The opposite policy is responsible for the very poor and miserable lighting service to be found abroad on the continent of Europe. Nothing is more important, vital and essential to the well-being and success of all electric lighting. One of the leading officials of the United Gas Improvement Company, at Philadelphia, recently instructed one of its largest properties using over 100,000 lamps a year, to furnish lamp renewals free, and gave it as his opinion that only by free renewals can an electric lighting service be properly maintained. Experience has given most positive evidence on this point. Free renewals is the policy of the leading electric stations, and station after station in the East and South are gradually coming to this liberal policy, by which they can control directly their own lighting results, instead of permitting the customer to buy the lamp, and thereby balk all efforts of the station to secure good lighting.

Now, gentlemen, here is the condition confronting you—it is not a theory. The incandescent lighting service of every station in this section is capable of much improvement. It does not answer the question nor solve the difficulty to put the blame on the customer, because he does not renew his lamp. He does not and can not understand the essentials of a lamp, and invariably blames the company for his poor results. You only pile up trouble and poor returns for yourself by endeavoring to make the customer, from whom you derive your income, responsible for the character of your service. Some other standard than "a customer's kick" should prevail. I earnestly recommend the early adoption of free lamp renewals by all stations, with their meter customers. It improves lighting results more promptly and directly than any other department of central station service. It assists the stations to increase their business, and hold their old customers in a way nothing else can. It is a wise and profitable policy, and one that all lighting companies should follow. With your contract customers, sell lamps, if you will, but sell at a low price, low enough to induce the customer to buy all his lamps at the station and thus exclude the cheap and worthless lamps.

With your meter customers, however, adopt free lamp renewals, and be able to control and regulate your lighting results, and make electric lighting so good that no one can afford to do without it.

Machinery Exhibition at Christiana.

United States Consul Bordewich sends from Christiana a programme of the permanent machinery exhibition which has been opened in that city. Manufacturers, agents and other interested parties are invited to exhibit. The programme sets forth that machinery, tools, etc., can be exhibited at a low rent in centrally situated rooms. Appliances can be shown in operation without extra expense for driving power. New and patented machinery and appliances may be exhibited and advertised cheaply and effectively. Catalogues of the exhibition will be distributed without extra expense to the exhibitors. Mr. Bordewich advises that new inventions should be patented in that country before they are shown. Application for patent in Norway should be made within six months after patent is granted in the United States. Import dues are light. Goods should be sent knocked down, if possible, to save freight. For information, address the Alfheim Company, St. Olofsgade, 22, Christiana, Norway.

CORPORATION NEWS

WILMINGTON, DEL.—National Electric Hose Signal Company, of Boston, to make and sell electric hose, batteries, wires and signals; capital, $150,000.

TRENTON, N. J.—Hub Motor Company, with a capital stock of $1,500,000. The incorporators are: L. B. Dailey, E. J. Dudley and K. K. McLaren.

NEW YORK CITY—The B. B. Electric Company, of New York city. Capital, $30,000; directors: J. T. Beswick and David Beswick, Brooklyn; E. Nicholson, New York city.

WILMINGTON, DEL.—Keystone Electric Company, Philadelphia, to engage in manufacturing, engineering and construction; capital, $200,000.

ETNA, IND.—The Etna Telephone Company, of Etna, Whitney County, has been incorporated. Capital stock, $600; directors: J. W. Scott, John F. Bockman and Lawrence Gerard.

WILMINGTON, DEL.—The Wyoming Telephone Company, to construct and operate telephone lines in Wayne, Wyoming, Lackawanna and adjoining counties of Pennsylvania; capital, $10,000.

NEW YORK CITY—New York District Telegraph Company, of New York city, to provide messenger service. Capital, $5,000; directors: Dennis W. O'Day, Alfred A. Kearney and Mary O'Day, New York city.

TRENTON, N. J.—Eastern Telephone and Telegraph Company, to operate lines in New Jersey. The capital stock is $250,000. The incorporators are: J. W. Morgan, John J. Burleigh and E. A. Armstrong, of Camden, each holding $27,500.

CHEYENNE, WYO.—The Osborne Elevated Railway Equipment Company, of Cheyenne, has been chartered to manufacture electrical supplies. Capital, $250,000; trustees: B. E. Osborne, J. A. McGeer, J. H. Pierson, F. E. Candy, C. F. Parcels.

ELWOOD, IND.—The Lea Electric Manufacturing Company has been incorporated with a capital stock of $50,000. The headquarters will be in Elwood, and the directors are: John L. Griffiths, Mortimer Levering, Jacob Loomis, Conway Robinson, T. J. Levering, A. A. Wells and Robert Schell.

MALONE, N. Y.—The Franklin County Telephone Company, to operate in Malone and the other villages of Franklin County. Capital, $8,000; directors: E. B. Ferensen, J. A. Crawford, M. S. Crawford, N. S. Ferensen, John Chambers, R. L. Crawford, of Hamden, and Frederick C. Ward, Delhi.

TRENTON, N. J.—The White Knob Copper Company, Limited, with an authorized capital of $15,000,000, to-day filed articles of incorporation. It is authorized to do a copper and general mining business. Edson Pearsall, R. Rennie Atterbury and William T. Pendleton are the incorporators.

TICONDEROGA, N. Y.—The Consolidated Graphite Company, of Ticonderoga, Essex County, to carry on a general mining business. Capital, $50,000; directors: F. E. Harvey, Sandy Hill; A. S. Harvey, Ticonderoga; G. W. Watkins, Moriah; W. F. Whitney, South Ashburnham, Mass.; A. H. Eggleston, G. D. Martenez and William Leavens, Boston.

AGAMENTICUS, ME.—The Agamenticus Light and Power Company has been organized under the Maine laws, for the purpose of operating an electric light plant in York, Wells and Kittery, with $50,000 capital stock, of which $100 is paid in. The officers are: President, Edward S. Marshall; treasurer, Joseph P. Bragdon, both of York. Certificate approved, April 3.

PLYMOUTH, MICH.—The Plymouth Telephone Company has filed articles of incorporation. The capital stock is $2,000, with $500 paid in. L. C. Hough, E. C. Hough, J. R. Rauch, C. H. Rauch, F. M. Briggs, B. B. Bennett, A. A. Tafft, Louis Steel, H. B. Joliffe, D. Joliffe and Charles A. Fisher are the incorporators; A. A. Tafft, C. H. Rauch, Chas. A. Fisher, E. C. Hough and H. B. Joliffe the board of directors.

NEW YORK CITY—The Thermo-Electric Company has applied to the Supreme Court for the voluntary dissolution of the corporation, and Justice Fitzgerald has appointed Louis Wendel referee, to inquire into the merits of the application. It was stated that the company ceased to do business in September last, has no assets, and the only liability is a claim of the city and county of New York for $4,920 personal taxes.

EL PASO, TEX.—The El Paso & Juarez Traction Company, with principal offices in El Paso, has been chartered; capital stock, $200,000. Purpose to construct, acquire, maintain and operate street railways in and near the city of El Paso, Tex., and Juarez, Mexico. Incorporated by: J. A. Terry, of New York city; Anson Mills, of Washington, D. C.; Max Weber, Joseph Magoffin and John A. Happer, of El Paso.

At a meeting of the shareholders of the Central Ontario Power Company, Limited, lately incorporated with a capital of $750,000, for the purposes of developing the Burleigh Falls and for other enterprises, the following directors were elected: Hon. Richard Harcourt, president; F. A. Hall, Perth, vice-president; J. Alex Culverwell, managing director; Hon. Senator Peter McLaren, Perth; Eugene Coste, M. E., Toronto; James Kendry, M. P., Peterborough; R. J. McLaughlin, Lindsay; F. W. Barrett, Edward T. Adams, M. D., Toronto; H. J. Taylor and H. E. Larkin, St. Catherines.

First of May Removals and Extensions.

The *Inland Printer,* of Chicago, has removed its New York office to Room 701 Norton Building, 110 to 116 Nassau street.

The Chicago Rheostat Company has removed its offices from 1012 and 1013 Monadnock Block to 48 West Jackson Boulevard, Chicago, Ill.

Mr. E. R. Grier, local manager for the Bryant Electric Company, has removed from 1436 Monadnock Block to the Williams Building, 200 Monroe street, Chicago, Ill.

Mr. J. W. Brooks, local manager for the Fostoria Lamp Company, has removed from the Monadnock Block to Room 601 in the building at 303 Dearborn street, Chicago, Ill.

E. P. Roberts & Company, consulting mechanical and electrical engineers, have removed from the Osborn Building to Rooms 603 and 605 in the Electric Building, Cleveland, Ohio.

Rossiter, MacGovern & Company removed, on May 1, to the eighteenth floor of the building at 141 Broadway, New York city, where they have greatly enlarged offices and increased business facilities.

The Armour Plant in Chicago.

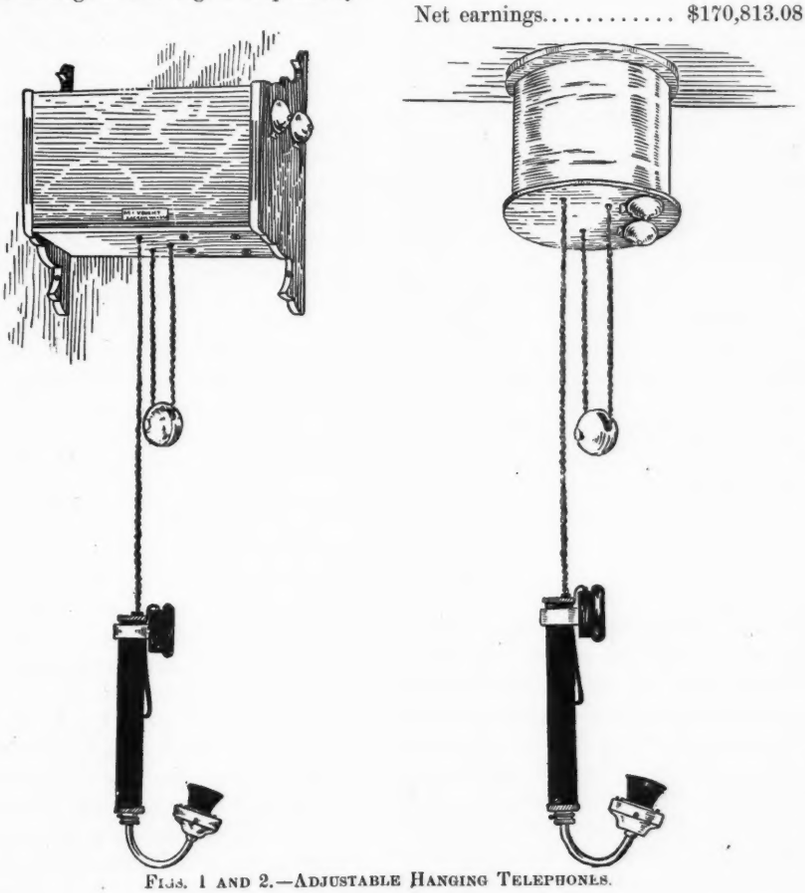
Among those present at the opening of Armour & Company's new electric power plant, described in the ELECTRICAL REVIEW last week, were the following-named well-known gentlemen:

C. C. Warren, president of the Warren Electric Manufacturing Company, Sandusky, Ohio; J. Roe and B. W. Van Voorhis, of the Crocker-Wheeler Company; J. J. Sullivan, of the Hamilton-Corliss Engine Company; M. E. C. Wilson, of the Knowles Steam Pump Company; E. R. Stettinius, of the Stirling Company, Chicago; Hermann Andrae, of Julius Andrae & Sons Company, Milwaukee; J. Holt Gates, of Chicago; James W. Buell, of the General Electric Company; George B. Foster, of the Wagner Electric Manufacturing Company; J G. Pomeroy, of Chicago; E. E. Wade, Colorado Springs; Dr. F. W. Gunsaulus and Professors Alderson and Monon, from the Armour Institute of Technology: Frederick Nelson, of the Westinghouse Electric and Manufacturing Company; James Lyman, of the General Electric Company; Messrs. Doolittle and Pomeroy, of the Crane Company; W. H. Edgar, president of the Dearborn Drug and Chemical Company, Chicago; J. J. Muir, of the Bass Foundry and Machine Works, Fort Wayne; Charles E. Brown, treasurer of the Central Electric Company, Chicago, and Dr. Pritchett, president-elect of the Massachusetts Institute of Technology, Boston.

The town of Pulaski, Va., has closed contracts for material for the construction of an electric light plant. The Ames Iron Works furnish, through their Baltimore house, the engines and boilers, and the Rumsey Manufacturing Company, of Philadelphia, will furnish the electrical supplies. The plant will cost from $10,000 to $12,000.

An Adjustable Hanging Telephone.

The illustrations shown herewith represent a very ingenious adaptation of the telephone which not only economizes space but possesses other advantages of great merit as well as unusual novelty. The illustrations themselves tell the story. The hanging combination receiver and transmitter is attached by cords and a counter weight to a box containing the magneto. This magneto may be attached either to the wall or to the ceiling as shown in Fig. 1 and Fig. 2 respectively.



FIGS. 1 AND 2.—ADJUSTABLE HANGING TELEPHONES.

The box contains both magneto and battery in the case of the wall outfit, but it is considered that, in the ceiling outfit, the battery is too cumbersome to be installed in the ceiling box which would have to be of large size for its accommodation, and it is consequently installed separately. Upon reaching for the telephone, and pulling it down the magneto is rung, or in case it is desired to move the telephone or adjust it without ringing the magneto, simply pressing a small hand lever on the handle of the instrument disconnects the magneto. As a convenient telephone adjunct this ingenious arrangement, which is made by M. I. Vought, of La Crosse, Wis., certainly possesses many features of both merit and interest.

United Electric Light and Power Company.

The United Electric Light and Power Company, of Baltimore, has just declared a semi-annual dividend of two and one-half per cent on its preferred stock, payable May 1. The company presents the following showing for the six months ending April 30, 1900:

Gross earnings.....	$342,210.64
Operating expenses, including insurance.....	174,397.56
Net earnings.....	$170,813.08
Fixed charges and taxes....	96,671.39
Net profits.....	$74,141.69
Semi-annual dividend on pref., 2½ per cent.....	17,500.00
Surplus.....	$56,641.69

The common stock of the United Electric Light and Power Company is owned by the United Railways and Electric Company, which exchanged $2,000,000 of its common stock for that of the Electric Light Company. The statement for the six months, according to Hambleton & Company, indicates a profit for the railways company of $100,000 for the year.

The Sultan has prohibited the importation of electrical goods into Turkey.

THE POWER IN A POUND OF COAL.*

BY E. D. MEIER.

Let us take a pound of what we will call average coal, containing, say, 10,000 heat units. This would be somewhat smaller in size than a man's fist. A pound of this coal, if expended in mechanical work, would give us 236 horse-power. Imagine at the time of the Pharaohs two long lines of men, extending over half a mile, all pulling steadily, at the command of the task-master, at a great rope to raise some huge obelisk, and as you see them sweating, tugging and straining, think again of this small lump of coal in which nature has placed an equal amount of power. In some countries men who have been specially trained as porters, to carry heavy loads on their backs, will, as a full day's work, carry a total of from 350 to 600 pounds a distance of one mile. And yet each has expended but one-third of the power stored up in this pound of coal.

An exceptionally strong man has been known to do one-half horse-power of work as his mightiest effort; but in two and a half minutes, work at this rate exhausts his muscular force. Let us suppose 100 such men putting forth such extreme effort at rope or crank or crowbar; as they fall back, red-faced and puffing, to catch their breaths, we might imagine this little black lump saying to them: "I can do as much as your whole company, and then can stand it for fully two minutes longer before I am exhausted."

Let us now turn to another portion of the human race. From the earliest times spinning has been a much-prized accomplishment of the fair sex. We need look back only to our own grandmothers. We can picture them, from their own stories told us when we were children, as rosy-cheeked damsels sitting around the open fire-place and spinning from early candlelight till bedtime, let us say possibly two hours. Let us then consider for a moment the thousands of spindles rattling and whirling in a modern cotton factory, impelled by the power locked up in coal. One pound of this coal carries the potential energy to do the work of 3,000 such spinsters.

In sawing wood a man may work at the rate of about 60 strokes a minute and consider himself a "top-sawyer," and his saw blade may have progressed five feet a minute; but a circular saw, driven by machinery, may be put through 70 times that distance and saw 70 times as much wood. And yet this one little pound of coal contains power enough for 180 such saws.

[While the quotation above is literal, it is, of course, evident that the author means 236 horse-power-minutes as the energy of the coal.—EDS.]

* From an article in *Cassier's Magazine* for May.

PRIMARY BATTERY TROUBLES.

BY C. F. OVERBURY.

The seeming impossibility of getting two or more primary batteries to act exactly alike under apparently similar conditions is due to many causes not thoroughly understood by battery users. In the carbon-zinc types, especially, this difference is very marked and the variation more serious. The carbons of one cell will be more or less porous than the next. The quality of carbon used may differ widely even in that which is manufactured by the same works; and with the process of moulding and pressing now in use, it is impossible to turn out every carbon exactly alike. This difference in structure and material affects not only the current but the voltage. The conductivity of a hard carbon is greater than that of a soft one, as the particles of carbon are in better electrical connection, but the surface is lessened considerably, and with some electrolytes the voltage is less than with a soft carbon. The quality of the carbon used affects the strength of the cell to a very marked degree and some carbons are practically worthless owing to this cause. The impurities of the carbon vary with different lots and are the cause of difficulties hard to counteract.

The zinc is another weak spot in a battery and causes no end of trouble. Absolutely pure zinc can not be made at present in commercial quantities, and the smallest amount of iron or lead present will cause local action in the battery and gradually consume the zinc in addition to saturating the solution with zinc salt. There is always a slight local action at the water level between the zinc below the solution and that above, the two parts acting as a couple of opposite polarity. This action becomes very strong if there happens to be iron or other metal present in the zinc at that point. In some cases the zinc will be eaten entirely away and drop to the bottom of the jar. Only zinc from the most reliable firms should be used, as any other is very likely to be made from scrap zinc which may contain lead, brass or iron in varying quantities. A very good method to prevent the surface local action is to paint the zinc with some good insulating material for about an inch and a half at the water level. The zinc will also last longer if properly amalgamated. The mercury has peculiar tendency towards bringing the pure zinc to the surface, and also of preventing the electrolyte from coming in contact with the impurities in the zinc. Enough attention is not paid to this most important detail of battery maintenance.

The water used in a battery is perhaps one of the most important, and yet least considered detail of any yet considered. Many cells are filled with water that has been standing days and weeks in iron or lead pipes. The result is local action at once. Freedom from impurities in the excitant is also a most important factor. Iron is most frequently found, and in white salts can be detected by the yellowish color. Crystallization of zinc salt on the carbon and zinc is perhaps the greatest fault of the cells using sal-ammoniac as an excitant. The pores of the carbon become filled with these crystals, which increases the internal resistance of the cell and gradually decreases the active carbon surface. In addition to this, the crystals prevent the hydrogen from escaping and gradually lower the strength of the cell until it becomes useless. These ever-increasing crystals form also on the zinc, covering up the surface completely, and sometimes on the bottom of the jar, becoming so hard that the jars are often broken in removing them. It is the most serious fault that sal-ammoniac has, and is one of the principal reasons for the ready adoption of Federal Salt and Federalite by battery users all over the country.

When a cell using either Federal Salt or Federalite is about exhausted a milky substance is precipitated which washes out easily and does not affect the carbon in any way whatever. Unlike sal-ammoniac, Federal Salts contain an oxidizer which absorbs the hydrogen as fast as it is formed at the carbon; the cell therefore being always ready for renewal by charging afresh with Federal Salt. Such a cell rapidly recovers to its original electromotive force, which is impossible when recharging with sal-ammoniac. The crystals also prevent quick recuperation, and when a battery has had hard usage will sometimes cause a complete failure due to its inability to recover quickly.

So many cheap, inferior batteries are being put on the market that it is a wonder that more trouble is not reported. The best is always the cheapest when applied to battery material.

General Carriage Company's Electromobile Rates in New York City.

The General Carriage Company, which, as recently announced in the ELECTRICAL REVIEW, has established a public electromobile service in New York city, advertises its rates for all kinds of automobiles as 25 cents per mile.

How New York's Rapid Transit Road Will Benefit the City.

The city is to pay the contractor the amount of his bid for construction, while he, in turn, is to pay as rental the interest on the bonds issued by the city to provide the required funds, and in addition, one per cent per annum as a sinking fund, writes William Barclay Parsons, in *Scribner's Magazine*. At his own expense the contractor is to provide the equipment, including power houses and generating machinery, which the city is to purchase at the conclusion of the lease, at a valuation to be determined then by arbitration.

Under this arrangement the city obtains the benefit of the immediate construction of a rapid transit railway, and without burden on the tax-payers, because the contractor is to pay the interest on the investment. At the end of about 45 years the operations and accumulations of the sinking fund will have retired the principal, after which the whole rental will be net profit; while, on the conclusion of the lease, the city can make a new one on undoubtedly vastly better terms. The attractive features to the contractor are equally strong. He is saved all expense of financing; for the price paid by the city for construction is tantamount to a loan, and so procures his capital on the basis of the city's credit as against the rate a new private corporation would have to pay in the open market. He is absolved from attacks by abutting property owners, except for such damages as may result from his own carelessness; he is not subject to taxation on either his own property, such as the equipment, or on any of his rights under the lease; and last, but by no means least, he operates, not under a franchise, but under a contract, and therefore, according to the all-powerful protection of the Constitution of the United States, no new obligations can be forced upon him, nor can his privileges in any way be curtailed.

A. K. Baylor, of 18 St. Swithins Lane, London, England, formerly manager of the railroad department of the British Thomson-Houston Company, Limited, the English end of the General Electric Company, has returned to London after a five weeks' sojourn in the United States. His visit here was in the interests of various important British electric traction concerns. While here he made arrangements for the opening of an office at 508 Bowling Green Building, where he will be represented by his brother, W. Baylor, who until lately was in charge of the British Thomson-Houston Company's New York office.

TELEPHONE AND TELEGRAPH

The Bell Telephone Company, of Philadelphia, has declared a dividend of two per cent, payable April 27.

The Hudson River Telephone Company has voted to increase its capital stock from $2,000,000 to $3,000,000. The company has 42 exchanges, is putting up a new building for its purposes, in Poughkeepsie, N. Y., and is rebuilding lines constantly and putting in much underground service, all of which is very expensive.

The directors of the American Bell Telephone Company have decided that regular dividends on the stock of the American Telephone and Telegraph Company will be paid at the rate of $6 per annum, with extra dividends of $1.50 per annum, which is equivalent to $15 per share on American Bell Telephone stock at the present rate.

The books of the New England Telephone and Telegraph Company will be closed until May 7 for the annual meeting, and a special meeting of stockholders to be held at 15 Dey street, New York, May 7. At the special meeting, stockholders will be asked to consider and act upon the recommendation of the directors that the capital stock of the company be increased from $15,000,000 to $20,000,000.

A Chicago alderman has introduced an ordinance providing that all telephone and telegraph companies not now taxed on their gross income for the city's benefit shall pay to the municipality five dollars a year for each pole used by them. Where wires are laid underground the ordinance provides for a compensation of 15 cents a foot per year. If the ordinance becomes a law it is stated that the burden will fall on the two telegraph companies, as the measure will not reach the Chicago Telephone Company, which is already taxed.

The Mexican Telephone Company has filed this financial exhibit with the state of Massachusetts as of March 1:

ASSETS.	
Cash	$26,225
Patent rights	1,542,653
Miscellaneous	16,352
Balance profit and loss	246,018
Total	$1,831,248
LIABILITIES.	
Capital stock	$1,808,710
Debts	22,538
Total	$1,831,248

The Interstate Telephone Association, comprising about 30 independent companies of Kansas and Missouri, recently met at Fort Scott, Kas., with a full attendance, more fully to organize and adopt a plan for a systematic extension of the lines, so that the different companies may work in harmony, as competitors of the Bell Company. J. H. Basom, of Joplin, was reelected president, and Geo. R. Armstrong, of Pierce City, Mo., was reelected secretary; C. G. Wood, of Chanute was elected vice-president, and F. H. Wadelich, of Joplin, treasurer.

The Northwestern Telephone Company, of Joliet, Ill., is now fully organized with a capital stock of $500,000. The original incorporation called for was $2,500. At the meeting held on the ninth instant, reorganization took place and the following officers and directors elected: Wm. Christy, of Akron, Ohio, president; E. J. Clapp, of Warren, Ohio, vice-president;

NEW TELEPHONE TRANSMITTER, INDUCTION COIL AND RECEIVER.

E. R. Conkling, of Lockport, secretary and general manager; J. R. Nutt, of Akron, treasurer; H. H. Evans, A. B. Conkling, J. F. Harrall, of Aurora; Chas. F. Stotzer and E. H. Harrison, of Wauseon, Ohio, directors.

New Telephone Apparatus.

When telephone apparatus of various kinds is assembled in a talking circuit it does not always give the best results even though its component parts are all excellent. To attain the clearest and most distinct speech it is necessary that the various parts comprising the circuit should be constructed with reference to one another and to use together. It is for this reason that the Ericsson Telephone Company, New York, has produced the three types of apparatus shown in the little illustration herewith and consisting of a transmitter induction coil and receiver. The base of the transmitter is adapted to receive the induction coil, which is of a special type and constructed to work to the best advantage with the other two pieces of apparatus. The receiver is of the double-pole, horseshoe-magnet type and is of all-metal construction, with temperature compensation, so that changes of climate, etc., will not affect its adjustment. The resistance of the receiver and induction coil secondary is balanced to produce the best effect, and it is claimed by the makers that the three apparatus in conjunction produce admirable results on either a long or a short line.

ELECTRIC LIGHTING

Edward Moir, of Marcellus, has been appointed temporary receiver of the Clyde, N. Y., Gas and Electric Company on a petition for a voluntary dissolution.

The Edison Electric Illuminating Company, of Boston, has declared a regular quarterly dividend of two per cent, payable May 1. Books closed April 17 and reopen May 2.

The United Gas Improvement Company, of Philadelphia, has obtained control of all gas and other street and commercial lighting plants from New Rochelle, N. Y., to the Connecticut state line.

Negotiations are practically completed by which the plant of the Watkins, N. Y., Electric Light Company has changed hands, becoming the property of Watkins parties whose names the retiring owners decline to disclose at present for publication.

The water-power canal and power house of the Hannawa Falls Water-Power Company, at Hannawa Falls, on the Raquette River, four miles from Potsdam, N. Y., were almost completely destroyed, on April 18, by high water. The damage is estimated at from $25,000 to $75,000 and the completion of the plant will probably be delayed a year. The available capacity of the plant is said to be 12,000 horsepower.

The Electric Club of Cleveland.

The Electric Club, of Cleveland, Ohio, has issued a new hand-book containing the names and addresses of nearly all the electrical men in that city. The hand-book is neatly bound in morocco and is of convenient pocket size, containing electrical tables and a list of periodicals on file in the club's library. The present officers of the club are: Charles W. Wason, president; P. Yensen, first vice-president; C. S. Powell, second vice-president; George B. Tripp, secretary, and George M. Hoag, treasurer. The headquarters of the club are at 689 The Arcade.

Massachusetts Institute of Technology.

Lectures on "Electricity in Mining" are being given at the Massachusetts Institute of Technology, at Boston, by Mr. Timothy W. Sprague. These lectures are included in the curriculum of the course in mining engineering. Students of other departments have the privilege of attending them.

INDUSTRIAL NOTES

The Speer Carbon Company, St. Marys, Pa., is out with another jumbo postal card carrying news of interest to users of self-lubricating carbon motor brushes.

The Electric Appliance Company, Chicago, has issued an extremely neat and attractive fan catalogue giving the entire line of Dayton fans, together with prices, for the season of 1900.

The General Electric Company's supply department, Schenectady, N. Y., is distributing copies of its pamphlet entitled "Type H Oil Transformers." This may be obtained at any of the company's sales offices free on request.

Shapiro & Aronson, 67 Centre street, New York city, are manufacturing a new line of fixtures and they report that there has been a particularly good sale of their gas and electric fixtures. These fixtures are made in all styles and have a very handsome appearance.

The H. C. Roberts Electrical Supply Company, 831 Arch street, Philadelphia, announces a large increase of business. It has recently purchased a considerable quantity of new stock and informs its customers that it can promptly fill any orders for general electrical supplies.

The N. N. Hill Brass Company, East Hampton, Ct., is at present selling a large quantity of its telephone bells. These bells are made from steel, nickel-plated on copper, and have a much clearer tone than the old style of bell. This company is also manufacturing a large number of bells adapted to electrical and other purposes.

The Crown Woven Wire Brush Company, of Salem, Mass., will probably have the most complete exhibition of woven wire dynamo brushes at the Paris Exposition. It consists of framed exhibits showing over 50 different styles and shapes of brushes, and a framed exhibit of the Crown commutator compound will also be shown.

August Becker, 34 Oliver street, Boston, Mass., the manufacturer of the well-known Becker name-plate, writes us that he has recently shipped a large quantity of these name-plates to foreign countries where they have been used on machinery manufactured there. Mr. Becker states that they have given entire satisfaction to the firms trying them.

A. L. Schoonmaker, 158 William street, New York city, announces that the sale of mica has been greater this year than ever before and it is with difficulty that he has been able to keep up with the orders for his India and amber mica. He is at present sending out a considerable quantity to the export trade, the orders from which, he says, are continually increasing.

The Oxide Battery Company, of 1627 North Tenth street, Philadelphia, states that it has been sending out large quantities of its new oxide electric storage batteries. This battery has stood some very high tests in efficiency and durability, and is very light of weight. The company says that it is especially adapted for fan motors, electromobiles, dental work, etc.

The Linz Building, Dallas, Tex., a handsome brick and stone building of modern construction, contains the largest installation of chandelier ceiling-fan motors in the world. One hundred and thirty-nine W. E. standard ceiling-fan motors are being used. These fan motors are illustrated and described in Bulletin 24 F, issued by the Western Electric Company, Chicago.

The Vetter Current Tap, manufactured by E. B. Meyrowitz, of 104 East Twenty-third street, New York, is now being extensively used for purposes where a tapping plug and lamp socket combined is necessary. This tap can be fixed to any electric light fixture and other electrical devices without the loss of the lamp in the fixture. The maker announces that it is adapted to any system of electric lighting.

The Bunnell Telegraphic and Electrical Company, 110-116 Beekman street, New York city, announces that its newly equipped factory is now in good running order and that it is receiving many orders for its telegraph, railway and electrical supplies. It is now ready to quote prices on its latest keys, sounders and other instruments, which are being made by most experienced workmen and on the latest models of machinery.

Quick Work—On March 29, the Bullock Electric Manufacturing Company, of Cincinnati, received from Commissioner Peck a cablegram to duplicate the order for the 200-kilowatt engine-type generator which was lost with the French line steamer Pauillac. The shop order was entered the same day and notwithstanding the fact that not an ounce of material for the machine was available, the generator was completed, tested and shipped in just 23 working days, or on April 24.

Benjamin F. Kelley & Sons, of 91 Liberty street, New York, announce a large sale of their improved exhaust pipe heads. These heads, they claim, are applicable to all exhaust pipes, have the advantage of keeping walls and roofs of buildings dry, preventing the accumulation of ice and avoid the spattering of buildings and walls. The head is simple in construction and ready to be connected. It is arranged for durability and made of the best materials after the most scientific method.

The Bullock Electric Manufacturing Company, Cincinnati, Ohio, has just issued Bulletins 33A, 34A, 36, 137B, 144B, 176 and 186. These are intended to be inserted in the "Blue Book," or binding cover, which the Bullock Company recently sent out to its customers. These bulletins relate to direct-current multipolar generators, railway, light and power generators, marine lighting and power sets, power motors, engine type generators and large direct-coupled railway generators.

Mr. M. E. Baird, who for many years has been connected with the Eddy Electric Manufacturing Company, of Windsor, Ct., has taken the management for the eastern states for the Milwaukee Electric Company, of Milwaukee, Wis., manufacturers of direct-current dynamos and motors. Mr. Baird is exceptionally well-known to dynamo and motor users all over the United States and the Milwaukee Electric Company is to be congratulated on securing his services. Mr. Baird has taken offices at Room 321, Havemeyer Building, New York city, where he will be glad to welcome his friends.

The Incandescent Electric Light Manipulator Company, 116 Bedford street, Boston, Mass., is manufacturing several new lines of its well-known incandescent light manipulators. It has recently placed on the market several new styles of these manipulators and is also sending out a large quantity of its bulb cleaners. These bulb cleaners are made in different lengths and are adaptable for the cleaning of all incandescent lights to almost any height required. The bulb cleaner is simple in construction and closes over the lamp by an automatic attachment at its base, which clamp gives the necessary pressure for polishing desired.

The O. C. White Company, of Worcester, Mass., which manufactures adjustable electric light fixtures, particularly a ball-and-socket joint adjustable holder, reports an excellent business, especially in the latter line of goods for factory and shop use. They have found great success in railway shops, the Boston & Albany Railroad paint shops, the Pennsylvania Railroad shops, at Sayre, Pa., and many others making use of them. The Carnegie Machine Works, Washburn & Moen Manufacturing Company and American Steel and Wire Company are a few among many other large concerns that have used this arrangement. The fixture is such that the lamp can be instantly adjusted to any position.

The Joseph Dixon Crucible Company, of Jersey City, relates thus how it comes to be a manufacturer of graphite brushes for dynamos and motors: "Quite an important part of the Dixon plant is run by electric power. Like all companies similarly equipped we have had more or less difficulty with the brushes. They have either worn too rapidly, caused squealing or have sparked. About a year ago we thought we would see what we could do in the way of making a suitable graphite brush. After some experimenting we produced a brush that we thought pretty near right. We first placed them on our motors and later on our generator. They have been in use for nearly a year. They are far beyond anything we have been able to buy, both in economy and efficiency. They have been tested by others and found satisfactory."

ELECTRICAL PATENTS

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED APRIL 24, 1900.

647,932 Electro-magnetically-operated railway switch; F. E. Baldwin New York, N. Y.—A pivoted switch-tongue, an oscillating elastic support for said tongue which is adapted to raise its free end from its bed, and means for oscillating the said support and thereby shifting the switch-tongue.

647,940 System of train control; H. W. Buck, Schenectady, N. Y.—Motor cars, each having a collecting device, motors and a motor-controller, poly-phase motors operating the different controllers, a continuous-current supply system, and hand-operated devices between the supply and the poly-phase motors by the rotation of any one of which poly-phase currents are derived from the continuous supply and transmitted to the poly-phase motors.

647,945 Support for electric conductors; T. J. Cope, Philadelphia, Pa.

647,946 Electric igniter for gas engines; W. H. Cotton, Chicago, Ill.—An electric circuit, an electro-magnet in such circuit and having a secondary coil, a pair of relatively-movable electrodes in the circuit of the secondary coil, such electrodes being controlled by the electro-magnet.

647,960 Electrolytic cell; G. W. Gesner, New York, N. Y.

647,970 Apparatus for indicating leakage of current from electric conductors; Martin Kallmann, Berlin, Germany—An electrical conductor, a galvanometer, electrical connections therefrom to four different points upon said conductor, and resistances in said connections.

647,975 Automatic feeding and regulating device for machine-tools; H. A. Liebert, Milnrow, England.

647,980 Electric elevator; J. F. Morrison, Wellston, Ohio.

648,057 Third-rail insulator; E. W. Rice, Jr., Schenectady, N. Y.—Consists of a support, an insulating-body, means for permitting vertical motion between the support and the body, and means attaching the rail to the body.

648,069 Burglar and fire-alarm; J. W. Culp, Wakarusa, Ind.

648,081, 648,082, 648,083, 648,084, 648,085, 648,086 Electric rail-bond; C. F. De Redon, New York, N. Y.

648,092 Electro-magnetic electric-railway track switch; P. B. Williams, Washington, D. C.

648,117 Geographical globe; J. S. Stubblefield, Los Angeles, Cal.—A geographical globe provided with a magnet, the north pole of which is located in the globe to correspond with a magnetic north pole of the earth.

648,118 Commutator; H. P. Stubenrauch, Chicago, Ill.—Composed of disk-like sections, each having a body portion of insulating material, divided to form separable parts and segments

(Continued on page 36.)

WANTED—Young man with electrical training for position in large telephone central office in New York city. Must be well educated, active and not afraid of work. Permanent position with opportunity for advancement to capable party. Man with experience in engineering or traffic work preferred. Address, stating particulars of education and business experience, references, age and salary desired,

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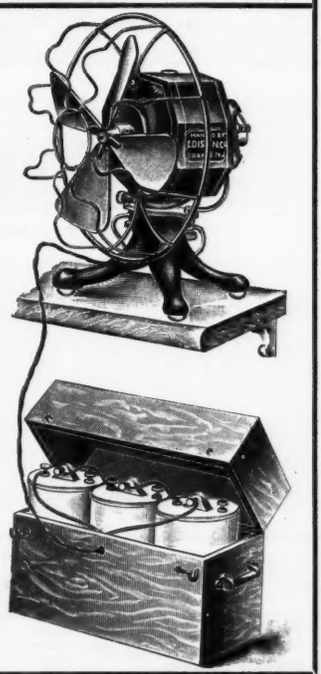

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"He who knows not, and knows not he knows not—he is a fool; shun him. He who knows not, and knows he knows not—he is simple; teach him. He who knows, and knows not he knows—he is asleep; wake him. He who knows, and knows he knows—he is wise; follow him."—Arab Proverb.
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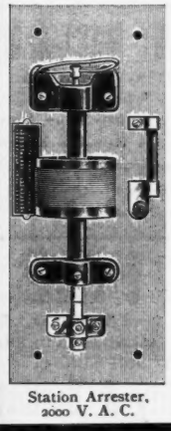

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A National Rider never changes his mount.—National Cycle Mfg Co., Bay City, Mich.

PATENTS.

(*Concluded from page 36.*)

secured to the periphery of said body portions.

648,122 Electric igniter for explosive engines; W. F. Davis, Waterloo, Iowa.

648,141 Inoxidizable corrugated blade or plate; A. Belmont, Paris, France.

648,144 Electric-lighting apparatus; R. N. Chamberlain, Depew, N. Y.

648,174 Insulating coupling device; O. W. Meyrowitz, New Rochelle, N.Y.

648,252 Electric signaling for railways; M. Garl, Akron, Ohio.

648,273 Brake for electric motors; C. A. Lindstrom, Chicago, Ill.

648,274 Controller switch; C. A. Lindstrom, Chicago, Ill.

648,295 Electric arc lamp; W. E. Pugsley, Lincoln, Neb.

648,296 Electric clock; P. M. Ravenskilde, Cabery, Ill.

648,335 Coin-freed electric meter; F. J. Beumont, London, England.

648,367 Firea-larm system and apparatus; R. A. Smith, Norfolk, Va.

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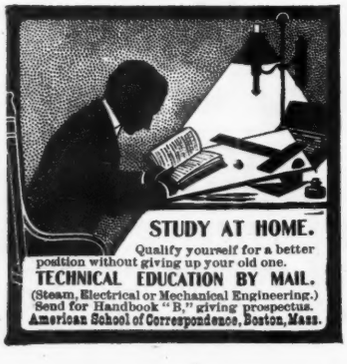
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